

# EVERYMAN'S SCIENCE

Vol. XLIX No. 3 (Aug '14 – Sept '14)

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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. Biresw Guha Street, Kolkata-700 017, with Dr. Ashok Kumar Saxena as Editor.

*Annual Subscription : (6 issues)*

Institutional ₹ 200/- ; Individual ₹ 50/-

Price : ₹ 10/- per issue

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\*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****EPIDEMIOLOGY OF NEUROLOGICAL DISEASE : ANSWER TO MANY QUESTIONS**

With the increasing lifespan of Indians, probably due to the available medical facilities and better nutritional intake, the problem of old age health has emerged. As the old population is increasing, the old age health problems need to be addressed by the health care system. The neuropsychiatric and neurodegenerative disorders are increasingly found in the old age. These diseases also account for one of the greatest burdens of diseases in the developed world. Though the mortality rate in these diseases is not high like that of many infectious diseases, the morbidity is immense and the support of healthcare system is required increasingly. As the number of traditional large families is decreasing in India due to changes of socioeconomic ambience, the healthcare givers are employed in many places. The trained caregivers for neurological diseases are not available often and the patients are mostly managed by non-professional personnel. Even this type of management is expensive and many families failed to provide the care to the patients. The life of these hapless patients is really miserable.

One can argue about the statistics and diagnostic standards of the neurological disorders, but the bottom-line is to find out ways to improve the situations. Some drugs are available which were discovered by the pharmaceutical industry (*Nature*, 507, 273, 2014). There are problems with some of these drugs. Many patients do not respond to these drugs and it is far from clear how these drugs

work in many places. The requirement of new drugs and therapies for these patients is understood. The understanding of the pathophysiology of some of these diseases is not sufficient to initiate research for drug development.

The neurodegenerative and neuropsychiatric disorders are broadly explained on the basis of genetic and environmental factors. Though the genetic implication in many of these diseases in developed countries has been reported, the information in these regard in Indian population is not sufficient. Some environmental factors related with these diseases were identified from the studies carried out in Europe and North America. The prevention of disease is apparent if the link between disease and environmental factors are clearly known. For example, the seasonal affective disorder (SAD), a mental depression found in North America in winter due to short day-light may be treated with phototherapy. However, this seasonal factor may not be important in India as the duration of day-light does not greatly differ between winter and summer. To identify the environmental factors for a disease, the need of epidemiological studies are imminent. Because it provides the distribution of patients in the population and may indicate factors related to the disease.

In one study (published in *British Journal of Psychiatry*, 158, 758-63, 1991) the month of birth of about 13,000 schizophrenic patients born in Scotland between 1914-1960 was noted.

It was found that disproportionately more patients were born in February to May. Therefore, seasonality effect was noticed. It was further observed that the relative number of schizophrenic birth in late winter and early spring was especially high if the temperature was lower than normal during the previous autumn. Probably in that condition people preferred to stay indoors which favored transmission of viral infection. From other studies, it was indicated that the brain development of fetus is adversely effected if their mothers are affected viral illness during the critical phase of the development (second trimester of pregnancy). The toxin produced by virus or the mother's antibodies against the virus may affect the development of the brain. If the viral infection is a causative factor, the schizophrenia should be seen in the babies born few months after an influenza epidemic, irrespective of season. This viral hypothesis has been supported from several studies. The serum level of Interleukin 8 (IL-8), a protein secreted by the cells of the immune system, was measured from the stored blood samples collected during pregnancy of mothers of children who developed schizophrenia later in life. This IL 8 is an indicator of inflammation and it's level was found to be elevated during pregnancy in the mothers of the babies who later developed schizophrenia. The maternal infection in the critical period of fetal

development may increase the incidence of schizophrenia in the women's children. The seasonal effect on the month of birth of schizophrenic patients may be due to the viral infection. It was reported that schizophrenia is approximately three times higher in people who live in the middle of the large cities than in those who live in rural areas. The transmission of infections/illnesses is easier in dense population. Probably viral hypothesis is also applicable to explain this observation.

This epidemiological study in schizophrenia shows the importance of such study in different climatic conditions. Considering the different climatic conditions in India compared to that of the countries where the previous studies were carried out, the environmental factors related to schizophrenia in India must operate in different ways. The answers of many questions related to a disease may come out from epidemiological study. Not only schizophrenia, other neurological disorders such as Parkinson's disease, Alzheimer's disease, Multiple sclerosis, Major affective disorders are influenced by environmental factors. Epidemiological study on these diseases in India is important to identify these factors, if any. Unfortunately, a paucity of information in this area is felt by many. It is the right time to initiate epidemiological study for such type of diseases in India.

*Dr. Ashok Kumar Saxena*

*"Believing is easier than thinking. Hence so many more believers than thinkers."*

*—Bruce Calvert*

## **GNOTOBIOTIC ANIMALS : A POTENT TOOL FOR LIFE SCIENCE RESEARCH**

S. Parthiban, S. Malmarugan, J. Johnson Rajeswar and V. Kumar

**Gnotobiotics is the scientific study of animals or other organisms that are raised in germ free environments or ones that contain only specifically known germs. The gnotobiotic laboratory animal is potentially a very valuable tool for investigating any suspected interaction between the host and its associated microflora or between different components of that flora. However, like many other good ideas, the production of gnotobiotics is simple in concept but complicated in execution. In the early stages the greatest obstacles to the general use of germ free animals were the expense and the restricted amount of space that could be maintained free from contaminants. Nowadays, with modern isolators and facilities it is easier to produce gnotobiotic animals at relatively modest price.**

### **INTRODUCTION**

**G**notobiotic animals (or) gnotobiotic are an animal stock or strain in which only certain known strains of bacteria and other microorganisms are present. Technically, the term also includes germ-free animals, as the status of their microbial communities is also known<sup>4</sup>. Gnotobiotic animals are derived by aseptic hysterotomy or hysterectomy, embryo transfer or sterile hatching of eggs and are continuously maintained using aseptic technique where the microbial status of the animal is fully defined; includes both germ free and defined flora animals. Animals reared in a gnotobiotic colony are devoid of normal flora, has poorly developed immune systems,

lower cardiac output, thin intestinal walls, low antibody titers low metabolism rate and high susceptibility to infectious pathogens<sup>3</sup>. Lower amounts of serum gamma-globulins have been observed in germ-free animals of several species, and the quantity increases on association with microorganisms. Nuttall and Thierfelder are considered pioneers of gnotobiotics and germ free research. Germ free mice have adapted anatomically and physiologically to life without microbes.

### **DERIVATION OF GNOTOBIOTIC ANIMALS**

The production of germ-free animals or birds depends upon the fact that embryos developing inside an egg or the mammalian uterus are microbiologically sterile, provided that they come from healthy parent stock. The uterus is removed and passed into the isolator

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through germicidal dip tank. Once inside the isolator, the uterus is opened and young ones are removed, cleaned, and then placed with foster germ free females. Hysterectomy does not eliminate pathogens that may contaminate fetus after uterine implantation or that is vertically transmitted. Vertical transmission of pathogens can be avoided by using embryo transfer<sup>2</sup>.

Birds are relatively easy to be produced germ-free. Germfree chicks, turkeys, and Japanese quail can be obtained by passing surface-sterilized eggs through a germicidal trap into a sterile isolator, where they are allowed to hatch. The fertilized eggs must be obtained from flocks free from microorganisms that invade the egg in the oviduct.

Rats and mice have been bred germ-free through many generations; other species have been bred but are not yet available commercially. The guinea-pig is well-developed at birth and readily takes solid food within a day or two, but the operator must work fast during delivery into the isolator as the fetuses do not survive more than few minutes after removal from the mother.

### **ISOLATOR TECHNOLOGY IN GNOTOBIOTICS**

Isolators are enclosures used to create the sterile environment. They must be made of material with an impervious physical barrier; main components are the chamber, air supply, air inlet and outlet, transfer port, and gloves; they come as rigid, semi-rigid, and flexible film isolators made of plastic or stainless steel. All manipulation of animals and supplies occurs within the chamber via the use of gloves and sleeves that are attached to the isolator walls. The glove is the most vulnerable part of the isolator in terms of contamination

potential. The transfer port is the enclosure that provides a transition between the isolator chamber and room environment; used for loading and removing items from the chamber it is the physical barrier to prevent contamination of the chamber. Isolators have HEPA filtration on air entry and exhaust. Positive pressure is used to prevent introduction of airborne contaminants through any punctures and is maintained when rearing germfree or gnotobiotic animals. If biohazardous agents are used in the incubator, negative pressure should be used. Air exchange rates are usually higher than the animal room some are 30 or more air exchanges per hour inside the chamber. Test the chamber for leakage using the gas leak detection test. The long term success of any gnotobiotic operation depends on the sterilization of the isolator chamber and the equipment/supplies that enter it<sup>6</sup>.

### **CARE AND MAINTENANCE OF GNOTOBIOTIC ANIMALS**

Mammals must be aseptically derived by hysterectomy or hysterotomy as late as possible before term. Inside the isolator the young are hand-fed on a sterilized liquid diet similar in composition to the mother's milk. If the animals are successfully brought to sexual maturity natural breeding can continue in the germ-free environment and other strains or even other species may be fostered on to lactating females. Rats and mice have been bred germ-free through many generations; other species have bred but are not yet available commercially. Among the larger animals the difficulties of sterile delivery increase with their size. Beagle dogs have been satisfactorily reared and used for physiological experiments. Germ-free pigs have been produced for many years, although the problems of handling and

caging limit their usefulness beyond the first few weeks of life. Lambs, calves and goats have all been maintained germ-free throughout the life.

### TERMINOLOGIES RELATED TO GNOTOBIOLOGY

**Germfree (axenic) animal** is free of all foreign life forms (e.g., bacteria, viruses, etc.) apart from it thought to be hypothetical state because indigenous or heretofore uncharacterized viruses may be integrated into host genome.

**Defined flora animals** are maintained in isolated environment and are intentionally associated with one or more known life forms, usually microorganisms.

**Specific Pathogen Free (SPF)** are animals free from specific pathogens but otherwise have an undefined flora.

**Restricted flora** – gnotobiotte associated with altered Schaedler flora from isolator but is then moved into a maximum barrier room where it can become colonized with additional organisms (but remains free of adventitial pathogens); higher level of SPF.

**Conventional animal** – animal reared in a room with an unknown microflora and unknown disease status.

### IMPORTANCE OF GNOTOBIOTIC ANIMAL

The gnotobiotic principles used in the production of infection free laboratory animals evolved from the efforts to rear and study animals in the absence of microbes or in

association with one or more pure cultures of microbes<sup>3</sup>. The gnotobiotic animal is potentially a very valuable tool for investigating any suspected interaction between the host and its associated microflora or between different components of that flora. The study of nutrition and metabolism is one to which the gnotobiotte has made a significant contribution<sup>1</sup>. Germfree animals are used in research involving various fields like toxicology, pollution control, autoimmune disorders, drug metabolism, genetic expression and vaccine tests<sup>5</sup>.

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## WATER BASED COATINGS

P. C. Thapliyal and Kirti\*

**The high performance requirements continue to be the most important criteria for various industrial markets such as automotive, agricultural and construction equipment, marine and others, including the plastics and wood segments. However, environmental regulations and ecological concerns now have become the main driving forces behind the development of new coatings. Research efforts in various laboratories have focused on reducing the Volatile Organic Compounds (VOC), while avoiding the use of toxic raw materials and striving to improve the coatings performance. Hence, water-based coatings have become the most practical approach to lower the emissions of VOC.**

### INTRODUCTION

Corrosion is the major reason of energy and material loss. It was reported that 1/5 of energy globally and average 4.2% of Gross National Product (GNP) is lost each year due to corrosion and the economic impact of corrosion is estimated to be greater than \$100,000,000,000 per year in the United States alone. Paint and coatings are widely used for the protection of concrete and metal structures against corrosion. Their protective characteristics can be enhanced by employing a suitable pigment. This improvement in the anticorrosive performance of the paint systems greatly depends on the kind, distribution and dosage of the pigments as well as their compatibility with the paint binder. Some pigments, e.g., lead-based and those containing

hexavalent chromium (VI), pose environmental concerns, and are regarded to be detrimental to health. Thus, despite their effectiveness in corrosion protection, they must be removed from paint formulations. Therefore, extensive research has been dedicated to the study of new anticorrosive coatings and pigments<sup>1-4</sup>.

Organic coatings are effectively used for the protection of concrete and metal structures due to their capacity to act as a physical barrier between the substrate surface and the corrosive environment in which they perform their function. Nevertheless, all polymers are permeable to corrosive species such as oxygen and water. Water molecules localized at the concrete/metal-film interface may induce a decrease in the coating adhesion, thus favouring the corrosion of the substrate under the film. The permeability characteristics of a coating are determined by diverse coating properties such as the nature and polymeric

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structure of the polymer, the existence of pores, the distribution of pigments and additives, etc. The protectiveness of organic coatings against corrosion can be enhanced by introducing pigments and anticorrosive additives in the coating matrix. In this way, paint systems are developed that contain either additives exhibiting active barrier properties, or pigments performing some additional protective actions to those originating from the barrier characteristics of the coating. In this last case, pigments may perform an electrochemical protection on the metallic substrate through galvanic or passivation mechanisms, or they may contribute to the barrier properties of the coating through the chemical precipitation of solid compounds. Either epoxy, acrylic or urethane chemistry is the leading technology behind most of the coatings systems.

The best coatings for corrosion protection provide not only barriers to corrosion, but also a 'smart' release of a corrosion inhibitor as demanded by coating damage and the presence of a corrosive environment. Past examples include coatings containing metallic Zn and chromate. Present and future efforts will take advantage of inherently conducting polymers as carriers for controlled release of inhibitors. Development of this technology requires an assay for evaluating the release of inhibitors from coatings. Similarly, the development and application of nano-functional materials and nano-structural materials made it possible to reform the coating materials<sup>5, 6</sup>.

### WATER BASED COATINGS

In recent years, government regulations have become stricter on Hazardous Air Pollutants (HAPs) and Volatile Organic Compounds (VOCs), creating higher demand for cleaner and safer synthesis of coatings.

Water-based coatings create very low VOCs and virtually no HAPs, making them ideal materials in industry. Further, when applying water based coatings, equipment can be cleaned much more easily, without the use of solvents or other chemicals<sup>7</sup>.

Water based coatings have been known since many years in the past although history of these coatings is not so old. Different types of water based systems known so far are:

1. White wash
2. Powder distempers
3. Cement paints
4. Oil-bound distempers
5. Oleo resinous and alkyd emulsion paints
6. Latex paints
7. Water soluble resin paints

The first three types, though extinct in the advanced countries, still continue to be used in India and other economically backward countries in variable amounts because of their comparatively lower price. Water based coatings, whether clear or pigmented, are designed by their behavior with water and the nature of the resin present therein, such as water dilatable, water reducible, water soluble, lattices and aqueous dispersions.

The main requirement for water-based coatings come from (a) to reduce the need for hydrocarbon solvents which are becoming expensive and short in supply (b) environmental legislation which was intended to reduce emissions to the atmosphere and (c) as a means of reducing the fire risk from flammable solvents. The major concern of this legislation is the reduction of air pollution caused by emission of toxic or irritating Volatile Organic Compounds (VOC) or breakdown products, into the atmosphere.

Resin and paint manufacturers are fully aware of unfavourable properties of water,

such as slow rate of evaporations, high surface tension and high latent heat of vaporization. Fundamental properties of water cannot be changed. However, deficiencies due to these properties have been shadowed by the tremendous success achieved by water-based coatings in reducing the use of solvent-based coatings on a performance basis <sup>1, 2</sup>.

Waterborne, higher solids, electro-coating and powder coatings are the most practical approaches used to lower the emissions of VOC. In general, chemical reactions are needed to cure these systems at either ambient or low or high bake temperatures, depending on the end-use applications. In the past two decades, several coatings systems have been studied and developed. Among the reported systems are those based on acid-epoxy chemistry, anhydride-hydroxyl reactions, epoxy-tertiary amine acrylic polymers, and other combinations. Among various commercial systems developed for the machinery, protective coatings or industrial maintenance markets, acrylic system, 2K polymeric tertiary-amine acrylic and epoxy acrylic, exhibits outstanding exterior durability with better gloss retention. These coating systems are either waterborne or solvent-based systems which are curable at ambient or bake conditions. The quaternization reaction between the tertiary-amine, epoxy and carboxylic acid is among the major cure reactions. While the performance properties of these systems are satisfactory for many of the more economical end-use applications, such as the machinery and protective coatings markets, additional improvements are needed to match the resistance properties of premium-grade solvent based urethane or epoxy systems. Especially anhydride containing "all acrylic systems" (AAA) have unique properties due to

the combination of covalent and ionic bonds which contribute to a tightly-formed network<sup>5, 6</sup>.

Considering the importance of the water-based coating systems, CBRI has done considerable R&D work in this area. As a result of this work, a team of scientists at CBRI developed the technology for water-based acrylic coating system for protection of concrete structures and epoxy based polymer latex for repair work. Water dilutable cement paints were developed earlier using white cement and alkali fast pigments. They are applied both as decorative and water proofing coatings for exterior wall surfaces. Bituminous polyurethane based coating system and sealing compounds were also developed and commercialized <sup>8</sup>.

## CONCLUSIONS

Corrosion is a global phenomenon in today's industrially advanced world. The awareness of corrosion and the need for protection against it is being felt more and more everyday, thus leading to the emergence of newer materials for corrosion protection. Coatings are the major source of corrosion protection and there are newer formulations and newer binders being tried to accomplish the job more efficiently. In this direction waterborne and higher solid coatings can contribute significantly to the green buildings and environment. Hydrosols, group transfer polymerization and aqueous microgels are some of the recent developments in this area. Still there is huge gap between demand and supply of the cost effective and environment friendly water-based coating systems and hence there is further need to develop new water-based coatings. At CBRI work is still going on to develop water based coatings for concrete structures.

Acknowledgment: Authors are grateful to the Director, CSIR-CBRI for his continuous guidance and encouragement.

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## ASSESSMENT OF THE ENVIRONMENT SAFETY ISSUES RELATED TO GENETICALLY MODIFIED CROPS

Bhausahab D. Pawar\* and Ashok S. Jadhav

**Agriculture has many constraints in crop production and conventional breeding is not able to overcome many of these constraints. Introduction of GM crops has demonstrated that they will play a key role in mitigating these constraints. Therefore, it is essential to have unambiguous national policy so as to efficiently exploit GM crops for second green revolution without any hazards to human health and the environment.**

### INTRODUCTION

The first green revolution resulted in significant increase in yield due to the introduction of high yielding varieties. Intensive agriculture practiced without concern to the scientific principles and ecological side resulted in loss of soil health, depletion of freshwater resources and agro biodiversity. During the past several years, growth in agricultural production has remained at a low level of around two per cent. In India, the yield of major food grain crops is reaching a plateau although its population continues to rise and is expected to reach 1.5 billion people in 2050. Also, 27 % of world's undernourished people live in India. This will require an increase of more than 50 % in agricultural production. To meet the growing demand for food and to contrast the detrimental effects of climate change on crop yields, it is essential to develop new crop varieties.

The wider exploitation of GM approaches will be needed for the increase in crop yield

via introduction of novel genes and alleles from diverse sources, and particularly for traits that are absent from plant genomes. Since approval for commercial use of GM crops in 1996, the global area under GM crops reached 148 million hectares in 2011 across 29 different countries. In India Bt cotton got approval in March 2002 since then the area under BT cotton increased substantially covering 86 % of total cotton area.

Plant breeders have continuously introduced new crops, genes, and traits into our diet. However, concerns with GM crops persist to some extent because of the perception that gaining access to a wider range of genetic diversity, crossing species barriers, and introducing foods with additional proteins present safety concerns. The approval of Bt brinjal by the Genetic Engineering Approval Committee on October 14, 2010 and the subsequent indefinite moratorium imposed by the Ministry of Environment & Forests on February 10, 2010, brought the issue of GM crops into the public eye. A number of biosafety issues of transgenic crops are being debated.

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## SAFETY CONCERNS ABOUT GENETICALLY MODIFIED CROPS

### Assessment of Possible Toxicity And Allergenicity

The possibility that genetically modified (GM) foods could be a source of novel allergens continues to concern consumers, and has contributed to the lack of acceptance of GM foods. The allergenicity and toxicity assessment for the GM crops should be set on a case-by-case basis. The issue of GM-related allergies burst up for the first time in 1996, when researchers showed transfer of a major allergen from Brazil nut into soybeans also transferred its ability to activate allergic reactions in individuals with pre-existing Brazil nut allergies. The gene in question, coding for the 2S albumin, was being used to improve the nutritional quality of soybeans for animal feed. This discovery prompted consumer groups, as well as scientists, to push for comprehensive testing of the potential allergenicity of GM foods. Another example of allergenic concerns arose, when traces of StarLink™ corn were detected in some food products, such as taco shells. StarLink™ was only approved for use in animal feed, but not for human consumption. Approval for human consumption was withheld because the Bt Cry9c protein in corn did not disappear as quickly as other Bt proteins in test assays. The FDA evaluated the actual case samples against reference samples and these studies found no allergenic reactions associated with Cry9c.

There is enough scientific data proving Bt protein is non toxic to human and animals. Bt protein is denatured upon cooking. There is not a single report of adverse effect on human health. Bt crops have been grown around the world since 1996 without any reported adverse health implications. It has been well

established that the Cry protein cannot cause any toxic effect in mammals because of lack of highly specific receptors and acidic environment in the gut.

### Use of Antibiotic Resistance Gene

Selectable marker genes, that confer resistance to antibiotics or herbicides, are generally incorporated along with the gene of interest in a transformation process so as to allow the recognition of the transformed cells from a background of untransformed ones. Certain selectable markers like kanamycin and hygromycin resistance genes, that are proven to be safe, and other antibiotics that have outlived their clinical utility may be utilized till better alternatives are available. Although, there is no scientific evidence of the adverse environmental effects of selectable markers still there is a need to apply alternative principles of selection, as more transgenic traits have to be incorporated into a transgenic crop and because of concern that the use of conventional marker genes may pose a threat to humans and environment. New classes of marker genes are now available, conferring metabolic advantage to the transgenic cells over the non-transformed cells. Transgenic plants are can be produced by the use of marker genes that do not rely on antibiotic or herbicide resistance but instead promote regeneration after transformation. Also, the information regarding biosafety of the selectable markers should be upgraded to facilitate objective decisions by the regulatory authorities.

### Genes Escape from GM Groups

Genes may escape from GM crops through pollen transfer, as seed escapes, horizontal gene transfer through transformation and transduction processes. Advantageous genes

from the transgenics may be introgressed into the related wild species. Crossing of GM crop plants to wild and weedy relatives was major concern to environment. Although gene flow itself is a natural phenomenon and a risk, gene flow can be of concern if there is a possibility of the gene introgression into the recipient wild population that leads to undesirable consequences especially in case of herbicide tolerant transgenic plants. The overuse of particular herbicides, such as Roundup, has repeatedly led to the appearance of weeds resistant to Roundup or other herbicides. Such weeds have often originated in and around crops where any herbicide was used extensively, and their appearance is not directly related to whether GM crops are being grown. If weeds are present that are closely related to the crops, they may acquire immunity to the effects from which the crops were protected and be more difficult to control among them. Another concern is the transfer of genes from GM crops of a given species and other non-GM crops of that species. The effects of such gene transfer will depend on the nature of the genes, and the persistence of these genes will in turn depend on the selective pressures to which the plants with the new genes are subjected. The recipient crops may become resistant to particular herbicides, pests, and diseases. Horizontal Gene Transfer (HGT) is the transfer of genetic material directly to a living cell or an organism followed by its expression. Horizontal gene flow among unrelated species is very common among bacteria and very rare in human and higher species.

### Increased Weediness

Weediness means the tendency of the plant to spread away from the field where it was first planted. There are apprehensions about

GM crops becoming weeds. For example, a salt tolerant GM crop if escapes into marine areas could become a potent weed there. There is also fear about the development of super weeds i.e. a weed that has acquired the herbicide tolerant gene due to genetic contamination with a herbicide tolerance GMO through in field cross breeding to related species or through horizontal gene transfer. When genetically modified oilseed rape is grown on a large scale, the plants also grow on uncultivated land. According to a recent study presented at the Ecological Society of America conference in Pittsburgh, Scientists at the University of Arkansas (Fayetteville, USA) have now shown for the first time how far the GM rape has spread in the uncultivated environment. 86 per cent of canola plants, a variety of oilseed rape, found on verges and at petrol stations are genetically modified. The scientists warn that the feral GM canola could become a weed problem for farmers.<sup>3</sup> The scientists fear that the uncontrolled spread of GM rape that is resistant to both herbicides could become a stubborn weed in other crops because it would not be possible to control it with two of the most widely available herbicides.

### Adverse Effect on Non Target Organism

One of the concerns related to the release of GM crop is their potential adverse impact on non-target organisms. It has been reported potential negative impact in a laboratory setting of the Cry1Ab protein on larvae of the two spotted ladybird *Adalia bipunctata*.<sup>7</sup> This investigation along with some other studies showing negative impact of the transgenic MON810 maize on non-target organisms was used in Germany, to temporarily ban the cultivation of this Bt-maize. The study has

consequently been criticized as methodological shortcomings that make it doubtful whether the observed effects were due to direct toxicity of the two Cry proteins.<sup>5</sup> Cohik demonstrated no adverse effects of Cry1Ab and Cry3Bb1 to larvae of *Adalia bipunctata*.<sup>1</sup> In addition, a number of peer-reviewed laboratory studies in which ladybird beetles were fed Cry1Ab- or Cry3Bb1-expressing maize material (pollen) or Bt maize-fed herbivores have revealed no negative effects on different life-history parameters of *C. maculate*. Scientists presented a clear conclusion during International Green Week in Berlin that genetically modified Bt maize is as safe as conventional maize. In fact, they say it is better for protecting species diversity in fields and that cultivation of Bt maize could help prevent soil erosion and conserve soil fertility. This is one of the results of research projects on the environmental impacts of GM plants that have been funded by Germany's Federal Ministry of Education and Research (BMBF) over the past 25 years.<sup>3</sup>

In another case, it was claimed that Bt toxin from residual plant material was poisoning caddis fly larvae but both reports were found to be wrong. An analysis of 25 studies similarly revealed no significance of Bt on honeybee survival, which is important for pollination of several crops. Similar influence on soil microbes has not been confirmed by several investigators.<sup>2</sup>

### Adverse Impact On Biodiversity

The protection of biodiversity and of ecosystem should be a top priority, as it is already in danger due various human activity and we depend on it fully now and for the future. There have been concerns about reduction in the genetic diversity in cropping systems due to use of improved crop varieties.

This decline in genetic diversity has occurred as the farmers have substituted traditional varieties with monocultures and with the development of more transgenic crops this problem will exaggerate. The introduction of genetically modified plants into the environment has been increasingly controversial, as illustrated by the ongoing debates concerning the commercialisation of Bt brinjal. There has been much research on ecology of transgenic crops; it has been observed that the ecological problems related to the cultivation of GM crops are same as ecological problems associated with conventional agriculture. European Commission published a compendium of the results of EU-funded research projects on the use and risk assessment of GM crops in 2010. The Commission concludes that genetic engineering per se does not entail any greater risks than conventional plant-breeding methods. The conclusion drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research and involving more than 500 independent research groups.<sup>4,3</sup>

Varieties developed from GM technology may lead to monoculture in different regions of the world. An alternative for this could be the use of transgene in suitable local varieties. The erosion of genetic diversity is a reality and needs to be contained. As a consequence, various nations, including India, have initiated wide collection of land races along with wild species to be conserved and maintained in gene banks. However GM technology has certain advantages over conventional agriculture which includes requirement of lower quantities of chemical pesticides and fertilizers which is more environment friendly than the conventional ones. Due to higher



productivity, GM crops protect biodiversity by lands not intensively cultivated, whereas conventional agriculture practices are highly destructive to biodiversity. Care needs to be taken for cultivation of transgenic as well as non-transgenic crops near the centers of crop diversity and impact assessment should be a regular activity. Uncertainties about environmental impacts are often cited as reasons for controversial and lengthy decision making over the cultivation of transgenic crops. In an attempt to reduced uncertainty, there has been much research in ecology of transgenic crops, however, this research seems to confuse rather clarify decision making.<sup>6</sup> Confusion between environment risk assessment and basic ecological research can lead to ineffective risk assessment. It should be noted that the concerns linked with the GM crops was due to inappropriate agriculture practice, lack of consideration to suitable planting plans.

## CONCLUSION

Environment risk assessment of transgenic plants should be carried out on a case by case basis considering the biology of the plant, the nature of the transgene and protein it produces, the phenotype conferred by the transgene, use of the plant and the environment where it will be introduced. Before their commercial release, GM crops must undergo an environmental risk assessment to ensure that they do not cause unacceptable detrimental effects to the environment. While discussing on GM crops we take into account only risks, and not the benefits. It is essential to convince the public about both risks and benefits of GM technology. Risk/benefit analysis is important to convince the public that in spite of certain risks, the GM products are more advantageous, and that

hazards can be mitigated. Needless regulatory load will increase costs of regulation and regulatory compliance and may results in more costly technology, and can seriously hamper technology development. Therefore, it is essential to carry out appropriate risk evaluation and regulate it systematically as the identified risks require. A transgene that has undergone broad biosafety assessment should not be treated as new, even if it is a new transgenic event, only the agronomic performance and the level and stability of transgene expression should be examined. The regulations must always be based on scientific risk assessment alone for safe utilization of GM crops.

GM crops are comprehensively tested, and there is no indication that they are less safe than their other counterparts. But still we are unable to use this technology because of some misperceptions which are not on the basis of scientific evidence. It is essential to have unambiguous national strategy so as to efficiently exploit GM crops for sustainable increase in crop yield without any hazards to human health and the environment. The Indian Biosafety Guidelines, developed during the last two decades, do tackle most of the biosafety concerns which are raised. It is essential to realise that GM crops are strictly evaluated and examined for any risk they may pose to human beings and environment. Only after confirmation through a standard set of investigations and protocols about its safety, a GM crop is released in the environment for cultivation. In India where the inputs were too costly, GM crops can immensely increase yields by providing the input in the seed. Agriculture needs GM crops to meet the needs of a human population that now exceeds seven billion people.

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## BIOFUELS : THE FUEL OF THE FUTURE

Dalvi Sanjaykumar N.

The twentieth century came with the attention of the people towards the use of biofuels. Biofuels are produced either from living organisms or from metabolic by-products (organic or food waste products). In order to be considered a biofuels, the fuel must contain over 80 percent renewable materials. It is originally derived from the plants through photosynthesis process and can, therefore, be referred to as a solar energy source. There are many pros and cons in using biofuels as an energy source.

Henry Ford's<sup>1</sup> seemingly prescient outlook is becoming much more relevant after many decades: 'We can get fuel from fruit, from that shrub by the roadside, or from apples, weeds, saw-dust-almost anything! There is fuel in every bit of vegetable matter that can be fermented. There is enough alcohol in one year's yield of a hectare of potatoes to drive the machinery necessary to cultivate the field for a hundred years. And it remains for someone to find out how this fuel can be produced commercially - better fuel at a cheaper price than we know now'.

### TYPES OF BIOFUELS

With petroleum reserves dwindling, the search is on to replace gasoline/diesel with a cleaner, greener alternative<sup>2</sup>. The introduction of biofuels would benefit developed countries through increasing energy security by reducing the dependence on fossil fuels and contributing to lower greenhouse gas emissions<sup>3</sup>. Vegetable oil is used in several old diesel engines that have indirect injection systems. This oil is also used to create biodiesel, which when mixed with conventional diesel fuel is compatible for most diesel engines. Used vegetable oil is converted into biodiesel.

Sometimes, water and particulates are separated from the used vegetable oil and then this is used as a fuel.

It is observed that in several nations, the diesel engines under warranty are converted to 100% biodiesel use. It has also been proved that most people can run their vehicles on biodiesel without any problem<sup>4</sup>. A large number of vehicle manufacturers recommend the use of 15% biodiesel mixed with mineral diesel. In Europe, a 5% biodiesel blend is generally used at fuel stations<sup>4</sup>.

Biodiesel is a famous biofuel in Europe. Biodiesel is a fuel composed of monoalkyl esters of long-chain fatty acids derived from renewable vegetable oils or animal fats. Vegetable oils and animal fats are principally

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composed of triacylglycerols (TAG) consisting of long chain fatty acids chemically bound to a glycerol. The chemical process by which biodiesel is prepared is known as the transesterification reaction, which involves a TAG reaction with a short-chain monohydric alcohol normally in the presence of a catalyst at elevated temperature to form fatty acid alkyl esters (FAAE) and glycerol. Biodiesel is composed of long-chain FAAE, whereas petrodiesel is a mixture of aliphatic and aromatic hydrocarbons that contain approximately 10 to 15 carbons<sup>6</sup>.

When biodiesel is mixed with mineral diesel, the mixture can be used in any diesel engine. This blend will exhibit properties different from neat biodiesel or petrodiesel fuels. Specifically, the most important fuel properties influenced by blending of biodiesel with petrodiesel are lubricity, exhaust emissions, CN, flash point, oxidative stability, low-temperature operability, kinematic viscosity, and energy content<sup>6</sup>. Biodiesel reduces particulate, carbon monoxide, and sulfur dioxide emissions compared to diesel fuel<sup>7</sup>. Specifically, the most important fuel properties influenced by blending of biodiesel with petrodiesel are lubricity, exhaust emissions, cetane number, flash point, oxidative stability, low-temperature operability, kinematic viscosity, and energy content<sup>7</sup>.

Bioalcohols are biologically produced alcohols. Fermenting and distilling sugar crops, starch crops that have been converted into simple sugars or processing cellulose bio-mass can produce bio-alcohols. These bio-alcohols are mainly bio-ethanol, bio-methanol<sup>8</sup> and rare among these are propanol and butanol. Biobutanol can be used directly in a gasoline engine and hence is considered a direct replacement for gasoline. The butanol can be

burned straight in the existing gasoline engines without any alteration to the engine or car. It is also claimed that this butanol produces more energy. Also, butanol has a less corrosive effect and is less soluble in water than ethanol<sup>4</sup>.

Bio-methanol can be produced from biomass and biodegradable fraction of waste and it is equivalent to methanol from non-renewable resources<sup>8</sup>. Fuel ethanol can be produced from direct fermentation of simple sugars or polysaccharides like starch or cellulose that can be converted into sugars<sup>10</sup>.

About 95% of ethanol produced in the world is from agricultural products<sup>9</sup>. Ethanol fuel is the most commonly used biofuel in the world and particularly in Brazil. In Brazil, the ethanol use as bio-fuel is very common. In the 80s, more than half of the Brazilian cars used 95% anhydrous ethanol, however, the lack of sugar and its high prices decreased this value in the subsequent years<sup>11</sup>.

Ethanol can be put to use in petrol engines as a substitute for gasoline. Also, it can be mixed with gasoline in any ratio. The contemporary automobile petrol engines can work on mixtures of gasoline and ethanol that have 15% bioethanol. This mixture of gasoline and ethanol has more quantity of octane. This indicates that the engine would burn hotter and more efficiently. In high altitude areas, the mixture of gasoline and ethanol is used as a winter oxidizer and thereby atmospheric pollution is decreased<sup>4</sup>.

The Ethanol fuel has less British thermal unit energy content. Thus, to drive the same distance, more fuel is required as compare to usual fuel. Also ethanol has a corrosive effect on combustion chambers, aluminum, rubber hoses and gaskets and fuel systems<sup>4</sup>.

Biogas is created when organic material is anaerobically digested by anaerobes. During production, there is a solid byproduct called digestate. This can be used as a biofuel or fertilizer. Biogas consists of methane. Landfill gas is created in landfills due to natural anaerobic digestion and is a less clean form of biogas. Dried manure, charcoal and wood are examples of solid biofuels<sup>4</sup>.

The combined processes of gasification, combustion and pyrolysis gives rise to Syngas which is a biofuel. Bio-syngas resulting from biomass gasification contains CO, H<sub>2</sub>, CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub> in various proportions 12, 13. The average bio-syngas from a downdraft gasifier with air as the oxidant contains 22.16% CO, 17.55% H<sub>2</sub>, 11.89% CO<sub>2</sub>, 3.07% CH<sub>4</sub>, with N<sub>2</sub> and other gases as the balance<sup>14</sup>.

By using the Fischer-Tropsch process, it can be transformed to a synthetic petroleum substitute. Biomass to Liquid via Fischer-Tropsch (BTL-FT) synthesis is gaining increasing interests from academia and industry because of its ability to produce carbon neutral and environmentally friendly clean fuels; such kinds of fuels can help to meet the globally increasing energy demand and to meet the stricter environmental regulations in the future<sup>15</sup>.

## SECOND AND THIRD GENERATION BIOFUELS

Some second generation biofuels that are being developed are Fischer-Tropsch diesel, bio-DME (Bio Dimethyl ether), DMF (Dimethylfuran), biomethanol, biohydrogen, wood diesel, mixed alcohol and biohydrogen diesel. Besides the development of an efficient and economically viable technology for ethanol production from lignocellulosic materials, other

processes based on the use of microalgae and continuous reactors with immobilized cells have also been strongly evaluated being considered as promissory strategies for a future development of this sector<sup>16</sup>.

**Table-1 : Comparison of some sources of biodiesel<sup>17, 18</sup>**

Crop Oil yield	(L ha <sup>-1</sup> )
Corn	172
Soybean	446
Canola	1,190
Jatropha	1,892
Coconut	2,689
Palm	5,950
Microalgae <sup>a</sup>	136,900
Microalgae <sup>b</sup>	58,700
<sup>a</sup> 70% oil (by wt) in biomass	
<sup>b</sup> 30% oil (by wt) in biomass	

Algae fuel, also called oilgae or third generation biofuel, is a biofuel from algae. Algae are low-input, high-yield feedstock to produce biofuels. As a matter of fact, average biodiesel production yield from microalgae can be 10 to 20 times higher than the yield obtained from oleaginous seeds and/or vegetable oils<sup>17,18</sup> (Table 1). With the higher prices of fossil fuels (petroleum), there is much interest in algaculture (farming algae).

The United States Department of Energy estimates that if algae fuel replaced all the petroleum fuel in the United States, it would require 15,000 square miles (38,849 square kilometers), which is roughly the size of Maryland<sup>2</sup>. Algae, such as *Botryococcus braunii* and *Chlorella vulgaris*, are relatively easy to grow, but the algal oil is hard to extract. There are several approaches, some of

which work better than others. Some microalgae have high oil content (Table 2) and can be induced to produce higher concentration of lipids.

**Table 2 : Lipid content of some microalgae (% dry matter)<sup>18</sup>**

Species	Lipids
<i>Scenedesmus obliquus</i>	11-22/35-55
<i>Scenedesmus dimorphus</i>	6-7/16-40
<i>Chlorella vulgaris</i>	14-40/56
<i>Chlorella emersonii</i>	63
<i>Chlorella protothecoides</i>	23/55
<i>Chlorella sorokiana</i>	22
<i>Chlorella minutissima</i>	57
<i>Dunaliella bioculata</i>	8
<i>Dunaliella salina</i>	14-20
<i>Neochloris oleoabundans</i>	35-65
<i>Spirulina maxima</i>	4-9

Macroalgae (seaweed) also have a great potential for bioethanol and biogas production. Three marine macroalgae (*Chondrus crispus*, *Himantalia elongata*, *Undaria pinnatifida*) are used as solid raw material for direct base-catalyzed transesterification<sup>19</sup>. One advantage of many biofuels over most other fuel types is that they are biodegradable<sup>3</sup>, and so relatively harmless to the environment if spilled<sup>4</sup>.

## WORLDWIDE PRODUCTION OF BIOFUELS

A number of countries adjusted price regulation, modified tax incentives, or adjusted targets, and national biofuels targets and blending mandates continued to evolve. For example, in a concession to market realities, Germany lowered the mandatory biofuels blend rate for all transport fuels from 6.25 percent to 5.25 percent for 2009. The rate will again

increase to 6.25 percent for 2010-14. The worldwide figures for ethanol production (annual) increased from 53 billion liters in 2007 to 76 billion liters in 2009. The biodiesel production (annual) increased from 10 billion liters in 2007 to 12 billion liters in 2009<sup>5</sup>.

India approved a new target of 20 percent biofuels blending in both gasoline and diesel over 10 years, along with tax incentives for growers of biofuels crops. The initial mandate was for E5 blending in 2008 but ethanol supply issues may have delayed that mandate. Countries with new biofuels targets identified in 2008 include Australia (350 million liters by 2010), Indonesia (blending 3 percent by 2015 and 5 percent by 2015), Japan (500 million liters by 2012), Madagascar (blending 5 percent by 2020), and Vietnam (300 million liters by 2020). Several blending mandates were enacted or modified in 2008, including in Brazil, India, Jamaica, Korea, and Thailand.

As per REN21 (The Renewable Energy Policy Network for the 21st Century): Renewables 2010 Global Status Report, the ethanol industry faced multiple challenges in 2009, both for corn ethanol and sugar cane ethanol. This resulted in limited additions to production capacity and to widespread consolidation as the assets of many former market leaders were acquired. The industry outlook had fundamentally improved by the end of 2009, with lower corn prices and higher crude oil prices than in the autumn. Europe remains the world's top biodiesel producer. It is currently home to almost 280 production facilities across 27 member states, but the sector continued to become stagnant. The second generation biofuels are not yet produced commercially as per this report, but the EU, USA and Canada, along with China, Brazil, India, and Thailand, are investing in research and pilot production projects<sup>5</sup>.

## CONCLUSION

There are various current issues with biofuel production and use, which are presently being discussed in the popular media and scientific journals. These may include the effect of moderating oil prices, the "food vs. fuel" debate, carbon emissions levels, sustainable biofuel production, deforestation and soil erosion, impact on water resources, human rights issues, poverty reduction potential, biofuel prices, energy balance and efficiency, and centralized versus decentralized production models. Apart from every debate we have to keep in mind that the biofuels are the best way of reducing the emission of the greenhouse gases<sup>3</sup>. They can also be looked upon as a way of energy security which stands as an alternative of fossil fuels that are limited in availability and also biofuels are renewable sources of energy. As one can realize from above discussion that today, the use of biofuels has expanded throughout the globe.

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## AEROBIOLOGY IS ESSENTIAL FOR BIOLOGICAL SCIENCE

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**Aerobiology is an interdisciplinary field covering environmental science, medical science, agricultural science and biological science. In fact all forms of life which become airborne are now included in the studies of aerobiology has emerged as a specialized branch of investigation in biological science.**

### INTRODUCTION

The term aerobiology came into use during 1930 for the studies of airborne bioparticulates which include pollen grains, fungal spores, etc. In fact aerobiology deals with bioaerosols, which are usually the particles, such as bacteria, fungi, viruses, dust mites, pollens, spores, and decomposers of cracked animals or plants<sup>1</sup>. Aerobiological investigations have been started in the beginning of 20th century. They are mainly derived from soil, water bodies, animals, plants and human beings<sup>2</sup>. Diffused and transmitted through the air, bioaerosols spread human diseases, such as infectious diseases, allergies or poisoning, as well as animal and plant diseases<sup>3</sup>. Interest in bioaerosols has risen sharply in recent years as their relevance to occupational and environmental health has become better understood. Their general importance in infectious disease, acute toxic effects, allergies and even cancer is now well recognized and their specific importance in relation to respiratory symptoms and lung function impairment has become a particular public health priority. Natural substances are

present in tiny amounts in an unfiltered air sample, including dust, gases, dried vapor droplets, pollen and spores, sea spray and volcanic ash apart from number of microorganisms.

Aerobiology has become an interdisciplinary science of great significance and applications drawing information from palynology, ecology, mycology, pathology<sup>4</sup>, agriculture, forestry immunology, clinical medicine and meteorology<sup>4</sup>. Most of the aerobiological work is carried out with reference to the Aerobiological Triangle<sup>5</sup>, described by a pathway like Source-Release-Dispersion-Deposition and Impact where environmental factors affect at each state. There are various ways of dispersal of pollen and fungal spores in the atmosphere and the most important factor is wind which transmits pollen and spores from the sources to target area. The world population is more than 7 billion with an annual growth of 1.8 %, approximately 1.5 billion houses, 1.21 billion People in India (about 17 % of Earth) and 330 million houses in India with 32% increase over past 10 years. Annually 2 million death and 3 to 4% global burden of diseases are due to air-pollution. The number of respiratory allergy to pollen and spores is estimated at 20 to 30% in atopic

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population and upto 6% in general population and Chronic Obstructive Pulmonary Diseases (COPD) is also seems that climate change is increasing the abundance of aeroallergens such as fungi, pollen which may result in greater incidence are severity of allergic diseases<sup>5,6</sup>.

## AIR

Air is an essential and important component of the ecosystem. Humans are in continuous exposure to air environment either outdoor or indoor. Hence the air environment is a crucial factor that affects human health. Air media contain microorganisms such as viruses, bacteria, fungi and their spores, pollen grains, algal fragments, apart from the fragments of these microbes, glucans and mycotoxins affect human health adversely. Exposure to toxins can lead to health effects such as fever, fatigue, nausea, headache, depression and the long term effect include respiratory diseases and cardiovascular problems. A range of airborne particles such as pollen, fungal spores, insect debris, animal dander, mites etc. are the recognized allergens<sup>5</sup>. Air quality has been a concern for more than 100 years and started around 1850 during the hygienic revolution, followed by outdoor environmental issues<sup>7</sup>. While indoor pollutant levels in most cases are higher than those of outdoor levels, researchers also found that most individuals spend 90% of their time indoors and inhale around 35 gallons of air each day. Since the air breathed in most often comes from the enclosed buildings, good indoor air quality is therefore very essential and critical to human health.

## ENVIRONMENT

In many environments including hospitals, schools, animal sheds, shopping malls, pharmaceutical facilities, food storages and

spacecraft environments, the presence of bioaerosols can compromise normal activities, making efficient monitoring crucial depends on numerous physical, chemical and biological factors<sup>8</sup>. Regarding microbial pollutants, among their typical indoor reservoirs are people, plants and animals, to some extent soil and water as well as human-made materials. In this type of work environment, biological agents can cause adverse health effects when transported in the air as bioaerosols<sup>9</sup>.

The research works on bioaerosols include the identification of source, the way of release and take off the particles, their dispersion and the manner of the deposition, identification, the objects of impact and the interaction between particles<sup>10</sup>. The sampling devices involve techniques that separate particles from the air stream and collect them in or a preselected medium. Impaction, filtration and impingement are three common sampling techniques used to collect and separate the particles. Air monitoring was usually done by using different types of volumetric samplers, such as Andersen sampler, Burkard sampler, Rotorod sampler, etc<sup>5</sup>. The seasonal air monitoring for at least three seasons (summer, winter and rainy) helps in understanding the component of air quality.

## BIOAEROSOLS

Airborne microorganisms are not regarded as air pollutants but should be considered as an important factor affecting air quality and human health. Bioaerosols enter and are dispersed into the atmosphere from a variety of sources. Nevertheless, weather variables such as wind speed, relative humidity, rainfall and temperature also influence spore behavior and dispersion in the atmosphere<sup>11</sup>. The changes in meteorological factors also affect aeroallergen production, which, in turn,

impacts the prevalence or severity of allergic illness via sensitivity and response pathways<sup>12</sup>. Climate change, caused in part by increased atmospheric concentrations of carbon dioxide and other greenhouse gases, is likely to result in increases in temperature, relative humidity, wind speed and rainfall were changes in the amount, distribution, and intensity of precipitation events, and increases in the intensity and frequency of certain extreme weather events<sup>10</sup>. Researchers summarized the current understanding of the science on the impacts of climate change on aeroallergens and on the interaction between aeroallergens and air pollution related to allergic diseases<sup>13</sup>.

A recent review took the further step of outlining adaptation options focused on the role of qualitative and quantitative analyses of airborne microorganisms by identification method, the predominant microorganisms and types are taken into consideration with individual microorganisms show movement of seasonal variations. In a particular type of allergy if the microorganisms load is more, we can suggest the peoples about the predication of the allergy and made the peoples alert to protect themselves from that particular allergy. The concentration of the investigated parameters and the resulting adverse health effect, then on the basis of the measurements of the concentration of the biological agent, reference values should make it possible to evaluate the quality of the environment and to determine specific type of setting<sup>14</sup>. On the values in occupational and non occupational environments for several microbial agents, that can be present in the air as bioaerosol components<sup>15</sup>. Although the air is not conducive to the growth and survival of microorganisms, it is the most important medium for carrying and spreading of biological agents. Biological

particles suspended in the air can be present in viable as well as nonviable forms. They can either exist as individual entities or create aggregates of biological structures. The presence of air is related to multiple aerodynamic factors, such as spore size, shape, weight and hygroscopic and electrostatic properties of their walls<sup>16</sup>. Such inhalation exposure can initiate numerous immunopathogenic reactions including allergies, infections, toxic reactions and other unspecified symptoms like the sick building syndrome.

### **CONCLUSION**

Epidemiological studies have shown that a few hundred million people around the world are exposed to biological agents. Unfortunately, there are no quantitative health based guideline values or thresholds for acceptable levels of microbial contamination. This is so because a dose response relationship for most biological agents has not been determined yet and is controversial in many aspects. It is not possible to identify individual species of airborne microorganisms or other specific biological agents responsible for health effects. Susceptibility to a specific biological agent is an individual feature of each organism with source data on environmental and occupational concentrations of biological agents are still insufficient and sampling methods using samplers and experimental procedures have not yet been properly standardized. We can conclude that the standardized air monitoring inspection with appropriate protocols may hopefully improve our understanding of the environment, such as how it affects human health? or how does it eventually lead to our understanding in procedures for improving the quality of the air that we breathe.

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## BRIDGING THE GAP BETWEEN SCIENTISTS AND CLINICIANS

Janet Jeyapaul

**This article focuses on the wide divide between scientists and clinicians engaged in cancer research. Highthroughput studies and extensive microarrying have occupied centre stage without taking into account the cell types involved and the progression of disease. This has resulted in 'inhibitors' of little clinical importance.**

Ever wondered why doctors emphasize on early detection of cancer? It is true. Only early detection can maximize complete recovery. Yet the aam aadmi arrives at the doorstep of the Cancer Hospital, well past the early stage. No doubt we hear of numerous heart touching stories of cancer survivors, and the many improvements in medication and treatment. But this article focuses on the billions of dollars and rupees poured into scientific research worldwide, and the gap that exists between scientists and clinicians. Last year the American Association of Cancer Research sent an important attachment along with its regular funding announcements, that of the staggering figures of cancer deaths.

According to the International Agency for Research in Cancer, WHO report, 2014, an estimated 14 million new cases will be diagnosed per year. Within the next two decades, this figure would rise to 22 million annually. Cancer deaths are estimated to rise from 8.2 million to 13 million per year. Asia,

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Africa and Central and South America account for 60% of worlds total cases.

Its seems cancer research has more or less moved supersonically in one direction- of technological finesse. Cultural compulsions have led scientists to do hyped up highthroughput studies with little clinical significance. Scientists have been preoccupied with genomics and proteomics and the latest 'omics' of the day without weaving it into the biology, pathology, progression of disease and clinical significance Clinicians, instead of taking the onus of such studies on themselves have taken their cue for research from the former.

Funding, has in the past, see-sawed dangerously according to the latest 'in thing'. When I was post-doc ing in Philadelphia, USA in the late 80s, the 'in thing' was to do, what was called in scientific banter, 'promoter bashing'. 'Promoter bashing' was nothing but mutagenesis of the promoter- systematically chopping and cutting the promoter to determine the minimum region of promoter required for gene expression. So major funding was allotted to 'promoter bashing' studies. Then came cloning, antisense RNAs, siRNAs,

microarrays, highthroughput genomics, proteomics, and microRNAs- the list is endless. Somewhere in the stampede to stay funded the cancer patient's fate was adversely sealed.

The biological nature of disease, the interaction of various cell types, the pathogenesis and progression of disease has not been dealt with in depth. This has resulted in a spurt of 'inhibitors' but none that have made it to clinics in a significant way. Basic science is important in cancer research to dissect out aberrant genes-oncogenes, mutated tumour suppressor genes, signaling molecules etc. However, there is little value in microarraying whole sets of genes at a given time point, with no information on the status of genes during progression of disease. More importantly, the interaction between cell types in pathogenesis and progression of disease needs to be taken into consideration. For example in tumours induced by BRCA1 mutation in luminal cells resemble human BRCA1 mutated breast cancer and basal cancers. BRCA1 mutation in basal cells form tumours that do not phenocopy histologically human breast cancer. Thus the aberrations that occur in distinct cell types is important.

Another important aspect is establishing appropriate xenograft models of cancer that phenocopy human cancers. It has been shown in breast cancer stem studies that cancers can be induced in mouse that do not phenocopy human breast cancer. In such models it is of little benefit to study the effect of inhibitors. While it is true that not one mouse model can

encompass the entire spectrum of heterogeneity of human cancers, it is important to establish the different mouse models that phenocopy histologically, pathologically and molecularly the human cancers.

Effective translational cancer research would involve a team of clinicians, epidemiologists, pathologists, radiologists, scientists from various disciplines - chemotherapy, biological sciences, oncology, genetics, basic sciences and educators / professors from teaching profession engaged in research. The last addition may be a surprise but professors often have a clearer perspective that is devoid of the strong scientific cultural compulsions/technological inclinations and therefore more open to cell based studies.

Being a professor myself and engaged in breast cancer, I find myself a bit detached from diehard cultural and technological driven science. In breast cancer, I am more struck with the heterogeneity of cell types and the diverse function of biomolecules in different cell types. Thus there is no fascination for me in studying biomolecules en masse!!

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## LIFE SKETCHES OF OFFICE BEARERS, SECTIONAL PRESIDENTS & RECORDERS OF THE INDIAN SCIENCE CONGRESS ASSOCIATION, 2014-2015



**DR. SARJERAO BHAURAO NIMSE**  
**General President**

Dr. S. B. Nimse is presently Vice Chancellor, Lucknow University. He was earlier Vice Chancellor, Swami Ramanand Teerth Marathwada University, Nanded (Maharashtra) (2008-2013)

Dr. Nimse completed M.Sc. (Mathematics-First Class) from Pune University, M. Phil. (Mathematics). He received U.P. Governor's Award for distinguished achievement in M.Phil. He completed his Ph.D. (Mathematics; General Topology), 1982.

Dr. Nimse previously served as Principal, New Arts, Commerce & Science College, Ahmednagar (M.S.) since March, 2004 to 16<sup>th</sup> July, 2008, Director of Management Institute (Institute of Management, Research and Rural Development, Ahmednagar (M.S.) during 1990-1998, Director, MBA Center, IBMRD, Ahmednagar (M.S.) 1986-1990, Member, Management Council, University of Pune, since February-2006, Dean, Faculty of Science, University of Pune, during Sept. 2001 to Sept. 2005, Chairman, Board of Studies in Mathematics, University of Pune, 1985 to 1991 and 2005 to 2008.

He is member of several National / Professional Bodies and also member Governing Council of the Consultancy Development Centre, Govt. of India, Ministry of Science & Technology, Department of Scientific & Industrial Research (DSIR), New Delhi w.e.f. 10<sup>th</sup> July, 2012 (for three years), Member, Steering Committee for XII<sup>th</sup> Five Year Plan on Higher Education, Planning Commission of India, New Delhi, since April 2011, Secretary, (Admin), Indian Mathematical Society (IMS), 1<sup>st</sup> April, 2007 to 31<sup>st</sup> March, 2011, Executive Committee Member and Sectional President (ICT Section) of ISCA (2005-06).

Dr. Nimse has published 12 books on Mathematics, 21 papers in International Journal and 11 papers in National Journal. 9 students have completed Ph.D. under his guidance, and presently four students are registered to Pune University and SRTM University, Nanded. He has been invited to deliver lectures lecture in different parts of the world.



**DR. ER. NILANGSHU BHUSAN BASU**  
**General Secretary (Membership Affairs)**

Born on 14<sup>th</sup> day of July, 1956, Dr.

Nilangshu Bhusan Basu graduated in Civil Engineering from Bengal Engineering College in the year 1977 with distinction. He completed his Master's degree in Structural Engineering from Jadavpur University in the year 1983 with distinction and successfully undergone training in River Basin Management at Thames Water Authority, U. K. in the year 1989. He has served as Chairman of Architectural Engg. Division of Institute of Engineers, West Bengal Chapter. He is also adorning the honoured post of the Vice President at the Institute of Public Health Engineers. Presently, he is working at The Kolkata Municipal Corporation in the capacity of the Principal Chief Engineer (civil). Under the supervision of his Engineering skills a good number of infrastructure projects for the city of Kolkata have been completed successfully. 40 MGD water treatment plant at Palta, 100 MGD pressure station for clear water at Palta, 100 MGD intake jetty with intake station of Palta, Networking for water mains, Booster pumping stations at Parkcircus, Bagmari, Ranikuthi, Kalighat Drainage pumping station of Southern Avenue, Automated computerized car parking system at Rowdan street (over ground ) at Lindsay street (underground) etc, are only a few among the large number of successful projects that he has so far undertaken. All the JNNURM projects of KMC worth ₹ 1000 crores had also been formulated and is being executed in his leadership. These prestigious projects include 134 year old underground brick sewer rehabilitation of Kolkata also. He has also been invited to deliver lectures in many National and International seminars in India and Abroad and has a number of International publications in prestigious engineering magazines too.



**PROF. ARUN KUMAR**  
**General Secretary (Scientific Activities)**

Prof Arun Kumar has over 31 years of teaching and research experience in Department of Earth Sciences, Manipur University. He initially started his research in the field of fluvial geomorphology with application of GIS and Remote using techniques in the watersheds studies in Manipur. He has carried out the landslide hazards studies along the National Highways in Manipur, North Eastern, Jammu & Kashmir and Himachal Pradesh India.

He has established number of seismic observatories in Manipur as well as NE India to monitor the ongoing seismological status as the region of Manipur, falls under highest Seismic Zoning map of India. He created the earthquake hazard awareness in a scientific manner in many schools in NE region where school children can witness to measure the earthquake epicentre parameters in their school earthquake laboratories. Approximately sixty observatories are operational in various higher secondary schools in the NE India.

Now, he is establishing a multi-parameter geophysical observatory at Imphal, Manipur to observe the earthquake precursory phenomenon by using the geo-electric, electro-magnetic, magneto-telluric, seismic & micro-strain through boreholes and anomalies due to

the crustal deformations. He has continued the crustal deformation measurements along active faults in (Swalbard) Arctic Region, which is quite interesting in estimating the Isostatic Rebound phenomenon for ongoing climate change. The entire research activities are financially supported by the Ministry of Earth Sciences (MoES), Science Technology, Ministry of Environment & Forest (MoEF) Government of India. He is presently the members of Programme Advisory Committee (Seismology Programme) of MoES and Expert Advisory Committee of Hydroelectric & River valley Projects of MoEF.

He has travelled various countries for attending International conferences, training programmes and research activities. More than fifty research articles in various International and national journals are published. Besides, two volumes are edited and contributed a scientific database on water balance of small watershed from Manipur. Ten students have been awarded and six are in progress for their Ph. D. degree. He has trained many of his research scholars and M. Sc. students in GIS, Remote Sensing and Seismology.

He is active member of The Indian Science Congress Association, Kolkata and enjoyed the elected post of Sectional President (ESS Section, 98 ISCA).



**PROF. DHYANENDRA KUMAR**  
**Treasurer**

Professor Dhyanendra Kumar is presently

Professor and Head, Department of Zoology, Veer Kunwar Singh University, Arrah, Bihar. He is Member Syndicate and Convener of the committee for Academic and Administrative reforms of Veer Kunwar Singh University, Arrah. He was Dean faculty of Science and was Coordinator College Development Council of the University. He was also Coordinator of Vidya-Sagar classes (a Video Conferencing Class-room programme) of the University. He is also a member (eastern zone- RAC) of central Board of Workers Education (CBWE) under Ministry of Labour and Employment, Government of India.

He did his M.Sc. and Ph.D. from Visva-Bharati University, Santiniketan. During his M.Sc. Classes he was selected to represent Visva-Bharati at Diamond Jubilee Session of ISCA at Chandigarh (1973) as a student delegate. He was also selected among 52 students across the country as a Post-Graduate Meritorious Student to attend Summer Institute at Porto-Novo, Annamalai University, organized by U.G.C. in 1972. He was Senior Research Fellow under Council of Scientific and Industrial Research at Visva-Bharati, Santiniketan (1976-1978) and obtained his Ph.D. degree in 1978.

Professor Kumar has more than 39 years of teaching and research experience and has successfully supervised 15 students for the award of Ph.D. degree. He is presently working on effect of pollutants on enzyme activity and also working on endocrine disruptors and has published more than 50 papers in the journals of National and International repute.

He was the Executive Secretary of 6<sup>th</sup> International Congress of *Asia Oceania Society for Comparative Endocrinology* (An International organization of 19 countries).



He has also represented ISCA and the Country at University of Kelaniya, Colombo- Sri Lanka at 65<sup>th</sup> Session of SLAAS (Sri Lanka Academy of Advances of Sciences). He was awarded 50000 Yen in 1990 to attend International Congress of Ecology at Yokohama, Japan. He is in the editorial Board and reviewer/ referee in a number of Journals of National and International repute. His research papers were accepted for presentation in several Seminars/ Symposia at Japan, USA, Thailand, Egypt, Netherland and China. He has organized and chaired various sessions of the International and National conferences on the topics like molecular signaling, endocrine disruptors, fish-toxicity, biodiversity and other environmental related issues.

Professor D. Kumar has worked as a Recorder in the Section of the Environmental Science of ISCA in 2005 at Ahmedabad. He was the Member Council from 2006 and 2011 and member of the Executive Committee from 2008 to 2011 of The Indian Science Congress Association.



**DR. S. K. MAHAPATRA**  
**President**  
**Section of Agriculture and**  
**Forestry Sciences**

Dr. Sankar Kumar Mahapatra was born on February 25, 1959 in village Chandipur, PO

Pindrui, District Midnapur of West Bengal. He completed his schooling from Pindrui K.I. Vidyaniketan, Midnapur. He did B.Sc. (Hons) in Chemistry in 1978, M.Sc. (Ag) in 1980 in Agricultural Chemistry and Soil Science from the prestigious Calcutta University, Kolkata. He worked in research projects as Junior and Senior Research Fellows, in University College of Agriculture, Kolkata and obtained Ph.D (Ag.) degree from Calcutta University.

Then he joined National Bureau of Soil Survey and Land Use Planning (ICAR), as Scientist in 1986 through Agriculture Research Service (ARS) Examination of ICAR and posted at Regional Centre Delhi, IARI Campus, New Delhi. Presently he is working as Principal Scientist. In the past 28 years of Agricultural Research Services he made significant contributions in the field of Soil Survey, Mapping, Correlation, Classification, Assessment of Soil Degradation, Agro-ecological Zoning, Soil Site Suitability, Land Evaluation and Land Use Planning. He has handled several research projects (Institutional, Collaborative, Sponsored) covering all the North Indian states. He has about 200 research publications. He attended numerous national and international Conferences. He is the life member of 8 Professional Societies. He served as Section Member (2004-05) and Sectional Recorder (2008-10) of ISCA, Councillor of the Indian Society of Soil Survey and Land Use Planning, Nagpur (2001-03) and Vice President from 2011 onwards, the Councillor of The Agricultural Society of India (2001-06), Assistant Secretary (2003-2006) and Joint Secretary (2007-2012) of Indian Society of Soil Science and Secretary, the Clay Minerals Society of India (2014-2015).

He is recipient of ISCA Best Poster Presentation Award, ISAS Best Paper Presentation Award and Distinction Certificate Award for Result Framework Documents given by Cabinet Secretariat, Govt. of India. He was Expert in Creation of Question Bank or ARS/NET Examination of Agricultural Scientists Recruitment Board.

He has been actively involved in organising several international and national Conferences/Seminars/Congress. He has also organized 2 Training Programmes of 21 days duration as Programme Coordinator, sponsored by NNRMS, Deptt. of Space, Govt. of India for the Central and State Government Officials.



**PROF. M. K. JYOTI**

**President**

**Section of Animal, Veterinary and Fishery Sciences**

Born on 17-05-1946, he had his primary and secondary education in Jammu and Post graduation (M.Sc. Zoology) from University of Kashmir. After having done M.Sc, he continued with Ph.D. programme at University of Kashmir as J.R.F of C.S.I.R. in the year 1973, He was appointed as Lecture in the Department of Biosciences of University of Jammu. He continued serving University of Jammu till 2006. It was during these 33 years of service that he was elevated to positions of

Associate Professor and Professor and during this period. He was also entrusted with different academic and administrative positions.

Dr. Jyoti served the University besides Professor of Zoology, as Head of Biosciences and Zoology respectively, Dean of Life Sciences, Director of Distance Education, Convenor/Coordinator Environmental Sciences, Biochemistry, Migrant Cell Kashmir University and M.Sc. Fisheries. He has also contributed to the academic growth of other Universities as member of their board of studies and through participation as resource person in their refresher courses.

His field of research primarily remained Fisheries and Limnology. He bagged an successfully completed several research projects awarded by U.G.C, C.S.I.R, I.C.A.R and MoE etc. He has supervised about two dozen M.Phil and one dozen Ph.D. scholars and published 60 research papers in Indian and Foreign journals.

He was picked up by newly created Central University of Jammu, where he worked for another three years and established a department of Environmental Sciences. He was sponsored by U.G.C. for visits to New-Zealand and Czechoslovakia under its academic exchange program.

During his active service carrier, he organized 6 national seminars and worked for the introduction of some new course in the University. He has been conferred with honours by the Inland Fisheries Society, Zoological Society of India and Indian Academy of Environmental Sciences.

Presently he is also Convener of Jammu ISCA Chapter.



**PROF. ANUP KUMAR KAPOOR**

**President**

**Section of Anthropological and Behavioural Sciences (including Archaeology, Psychology, Education and Military Sciences)**

Prof. Anup Kumar Kapoor, former Vice-Chancellor of Jiwaji University, Gwalior (M.P.), is an eminent Bio-Social Anthropologist of the country. Born on 20<sup>th</sup> Jan., 1954 in Delhi, Prof. Kapoor did his B.Sc. (Hons.) Anthropology (1973), M.Sc. Anthropology (1975) and Ph.D. (1981) from University of Delhi, Delhi. He did postdoctoral research on the High Altitude Tribal Populations of Himalayas (1981-83) supported by Indian Council of Medical Research, New Delhi at Department of Anthropology, University of Delhi, Delhi. He was appointed University Adhoc Lecturer (1983-86), University Lecturer (1986-1991), University Reader (1991-97) and Professor (1997-till date) in Department of Anthropology, University of Delhi, Delhi. His research interest covers Human Population Biology; Forensic Anthropology; Cultural Biology with emphasis on tribal, Himalayan and health studies; Biological Gerontology, Neuroanthropology and Human Rights. As an anthropologist he has carried out extensive and intensive fieldwork among tribes, castes and ethnic groups in the States and Union Territories. He has served

as the Principal Investigator and/or Co-PI for several research projects.

Prof. Kapoor has received several awards like Ruchi Award (1991); UGC Research Award (1999); Life Time Education Achievement Award (2006); Vidya Ratan Award (2008); Man of The Year Award (2009) and Dr. Panchanan Mitra Memorial Lectureship Award of the Asiatic Society (2014) for his outstanding contribution in Anthropology, Education and Human Development.

He has acted as Chief Guest, Guest of Honor, Chairperson, Co-Chairperson and Presided at various National and International Seminars, Conferences, Sports Functions and numerous Cultural Activities. Prof. Kapoor has also delivered Invited Lectures, Special Lectures and Keynote Addresses in various Conferences, Workshops and Seminars in India and abroad. He has served and has been serving as a member of the Editorial Board of Indian Journals and Reviewer of different International Journals. Besides his academic achievements, he has held various administrative positions like Deputy Proctor (1989-2004); Provost, D.S. Kothari Hostel (1999-2001); Treasurer, Indian Society of Human Ecology (1988-2002); Chairperson and Member of the Governing Bodies of NGO's and Colleges under University of Delhi; Vice-President of Indian Anthropological Association (1993-95); Member, Advisory Committee, Delhi University Students Union (1989-2004); Coordinator (Polls) between University of Delhi and National Election Commission of India (1998); Member, Academic Advisory Committees, Academic Staff Colleges of few Universities; Member, UGC Creation of New Academic Staff Colleges (2009); Member, Monitoring and Evaluation Committee of M.P.

Council of Science and Technology (2008); Chairman, Expert Review and Assessment Committee of DRS/DSA (SAP Programmes of UGC, 2007-2008); Member, UGC Expert Committee Human Rights Education (2008 & 2009); Member, UGC Expert Committee on Reforms of Affiliating System (2008). He has been the Patron and Member of the various Organizing Committee of National and International Seminars and Conferences.

Prof. Kapoor has published more than 230 research papers and articles in National and International Journals and authored/edited 15 books. So far 17 students have got their Ph.D. under his guidance and eight students are working under his supervision. He has written eight Forwards on the various books authored by scholars of different disciplines. He has participated in 98 Conferences, Seminars and Workshops in India and abroad.

He has been the Visiting Fellow to various Universities in India, Europe and North America. He is the Founder and Life Member of Several Prestigious Scientific Bodies and a Member of International Union of Anthropological and Ethnological Sciences (IUAES).



**PROF. A. P. MISHRA**  
**President**  
**Section of Chemical Sciences**

A. P. Mishra was born on 1<sup>st</sup> January, 1960

at Banda (U.P.). After the school education, he has completed his college Graduation from Bundelkhand University, Jhansi with merit in the year 1978 and Post-graduation from University of Allahabad in 1981 with second rank in merit. Prof. Mishra obtained his D.Phil. and D.Sc. from the University of Allahabad in 1985 and 2004 respectively. He has been recipient of JRF and SRF during his research work (1982-86). He was also awarded scientist-Pool officership (CSIR) to work in IISc., Bangalore in 1986. Prof. Mishra started his career as a lecturer in Dr. H.S.Gour University, Sagar in 1986; afterwards he moved to university of Allahabad and again joined H.S.Gour University in 1997 where he became Professor in 2006. In between, Prof. Mishra has also worked as UGC-Visiting Associate in IIT, Bombay in 1990 & 1991 ; under UNESCO program in IIT, Madras in 2000 and as INSA-Visiting Fellow in IIT Kanpur.

Co-ordination Chemistry, Structural Inorganic Chemistry, Bio-inorganic chemistry, Medicinal Inorganic chemistry, Solid State materials & nanoprecursors, microwave-assisted synthesis, Nanotechnology, Solution chemistry and Ultrasonics are the major research interests of Prof. Mishra. He has experience of more than 27 years in UG-PG teaching and 30 years in research. Under his supervision 15 students have earned Ph.D degrees and currently 4 are working. He has published more than 110 research papers in various reputed national and international journals. He is also co-author of two books. He has successfully completed five research projects. Bioactive Compounds synthesized by Prof. Mishra for metal chelation therapy have been recognized by NCI (USA) and TAACF (Birmingham). He has participated in more

than 100 national and international conferences/workshops and delivered number of invited lecturers in universities and colleges. His research work has been awarded several times in the form of best research papers in conferences.

Prof. Mishra has been involved in organizing several conferences as organising Secretary. He has been associated as Life Member/Fellow with a number of Professional/Academic bodies. He was elected as Vice-President, ICC (2011-14); Secretary, Central Zone, ICC (2001-2004), Executive Member (2005-07 & 1991-1994) of Indian Council of Chemists and Council Member, Indian Chemical Society (2014-16). He has been the Sectional President-Inorganic (2013) of Indian Council of Chemists at Karnataka University, Dharwad. He was elected as Sectional Recorder, ISCA (2002-04) and Member of Sectional Committee (Chemical Sci. ISCA) in 1998-99. He was the Executive Member of International Academy of Physical Sciences in 1997-98 and Active Member of New York Academy of Sciences.

Besides this Prof. Mishra had undertaken a number of administrative responsibilities in the university *viz.* Chairman, All India Entrance Test of Dr. H.S.G. Central University, Sagar in 2010 & 2012; Coordinator in University examinations. At present he is serving also as the Director of Institute of Distance Education, Member of University Academic Council and Coordinator, Sophisticated Instrumentation Centre, Dr. H.S.Gour Central University, Sagar.

Prof Mishra is an honorary Reviewer of several national and international journals. Currently he is Associate Editor of *J.ICS* ; Editor of Research Journal- Madhya Bharti (Science), Dr. H.S. Gour VV, Sagar and is also

in Editorial Board of ISCA Journal *Everyman's Science*. In past, he has been Associate Editor & Member of Publication Committee, Indian Chemical Society in 1997-98 and Associate Editor of Journal of Environment and Social science research.

Prof. Mishra has been associated with ISCA since 1985. He was Sectional Recorder-Chemical Sciences during 2002-04.



**PROF. K. L. SHRIVASTAVA**

**President**

**Section of Earth System Sciences**

Kanhaiya Lal Shrivastava is Professor of Economic Geology since May 2001 at Jai Narain Vyas University, Jodhpur, India where he has been teaching since 1982. He was born at Niwari (Madhya Pradesh) on 28<sup>th</sup> March 1959, obtained his M.Tech (Applied Geology) from Centre of Advance Study in Geology Sagar University in 1980 with University merit and Doctoral degree from Jodhpur University.

Professor Shrivastava is actively engaged in understanding different aspects of economic mineralization for the last thirty two years. His interest is purely dealing with the genesis and exploration of economic deposits of Igneous affiliations, sulfide deposits and mineral fuels. Unexplored from mineralization point of view, the Malani Igneous Suite is his main terrain of his interest. He has discovered new

carbonatites, signature of kimberlite and komatiite etc. He has also developed a 'Mossbauer log' for source rock evaluation of petroleum by leading first Indian working group on Mossbauer, recognized globally. Hon'ble President of India has given him special responsibility to explore 'calcrete type non conventional uranium' in Indian Desert. Presently, he is engaged with, by using high resolution Ground Penetrating Radar (first time in India) with high resolution satellite data and advance geochemistry.

Professor Shrivastava has edited two well reputed International volume 'Economic Mineralization' (2009) and Geo-Resources (2014). He has published one hundred and twelve papers. Professor Shrivastava has supervised 15 Doctoral theses and supervising 8 more.

Professor Shrivastava is founder member of South Asian Association of Economic Geology (Colombo, 1995). He is Chairman of Rajasthan chapter of the same. He has served as National executive of ISCA (2010-2013). He has elected Sectional President of The Earth System Sciences, ISCA (2014-2015). He is fellow of 15 scientific societies including Geological Society of India, AGID, ISTE etc. Professor Shrivastava has completed various projects financed by German Government, DST, UGC, AMD etc. and represented Indian subcontinent in several research working groups. His biography is published in many global dictionaries of the Biographic Institutes.

In Jai Narain Vyas University, Professor Shrivastava has served as Head and Chairman of the Department of Geology (2009-2012),

President of University Teachers Association (1997), Elected Senator (1991-1994 and 1994-1997), elected Academic Councillor (1988-1991), Incharge Deptt. of Geology, Faculty of Engineering (2001-2009), Hostel warden (1987-1997) and Chairman Yoga (1997-2012).

Professor Shrivastava was honoured by 'Prof. S. Sambegowada Goldmedal' for research contribution made on 'Framboids' in the year 1981 and 'Decree of Merit' by IBC, Cambridge in the year 1995. He was nominated for Vikram Sarabhai Award (2003). Professor Shrivastava has chaired eight international sessions and delivered numerous keynote addresses and invited talks in India and abroad.



**DR. ATUL SITARAM PADALKAR**  
**President**  
**Section of Engineering Sciences**

Dr. Atul Padalkar is born on June 1<sup>st</sup> 1962. He obtained his degree of BE and ME in Mechanical Engineering. He has completed Ph.D. in area of 'Alternative Refrigerants' under the guidance of Dr. Devotta. Dr. Devotta had been associated on the work which recognized for award of Noble prize to IPCC in the year 2007.

Dr. Atul Padalkar is founder of the Flora Institute of Technology, Pune. Presently, he is working as a Principal with the same Institute. He started his career in 1987 as a

Lecture at Rajarambapu Institute of Technology. Subsequently, he has served various prestigious institutions in capacity of Dean, Principal, Professor and Assistant Professor. Amongst, the University of Pune, Sinhgad College of Engineering, Pune (2004-2011) AISSMS College of Engineering, Pune, (1996 - 2003) respectively are important.

He has been mentor for introducing various academic programme which include B. Tech. Biotechnology, Post graduate programmes in Mechatronics, Computer Networks, and Communication Networks while working at the University of Pune. He is the founder Dean of Faculty of Technology and started Department of Technology at the University of Pune.

He is associated actively with various technological Institutions and technical bodies as Advisor, Member and Life Member. He has also worked as the Chairman, ISTE Maharashtra & Goa.

His contributions particularly development of room air conditioners with HC-290 and handbook on good servicing of room air conditioner under the aegis of German Technical Cooperation (GIZ), Germany has been recognised widely in the field of Engineering and Industrial Research. The work of development of hydrocarbon technology in air conditioners has been appreciated by UNEP and International Institute of Refrigeration (IIR).

He has published more than seventy research papers in journals of national and international repute. The important publications includes "Performance Assessment of Air Conditioners Using Propane" in Official Journal of Centro Studi Galileo (CSG) and

European Energy Center (EEC), "Performance Assessment of Air Conditioners with HC290" appeared in the Bulletin of the IIR, 2010. The same work has been published in Spanish and French languages.

He is working as consultant for corporate houses like Blue Star, Thermax Ltd., Godrej Appliances Ltd., India. He provides technical support for design and development of products to business houses.

He has attended more than score of national and international conferences and workshops.



**PROF. KASHINATH  
BHATTACHARYA**

**President**

**Section of Environmental  
Sciences**

Prof. Kashinath Bhattacharya was born on 25<sup>th</sup> November 1956 at Gangarampur, a small town of North Bengal where he completed his schooling in 1972 from Gangarampur High School under the West Bengal Board of Secondary Education. He graduated from City College, Kolkata (Calcutta University) and completed his M.Sc. degree in Botany from Calcutta University. He did his Ph.D. degree in 1985 from Bose Institute (Calcutta University) in the field of Palynology and Environmental Biology under the guidance of eminent Scientist Dr. Sunirmal Chanda. Prof.

Bhattacharya joined the West Bengal Education Service in 1985 as lecturer, posted in the Krishnagar Govt. College where he served for three years, then he joined Department of Botany, Visva-Bharati (a Central University) in 1988 as a lecturer in Botany. Dr. Bhattacharya is presently Professor of Botany, Visva-Bharati and was Head of the Department from 2009 to 2012.

Prof. Bhattacharya has about 30 years of teaching and research experience. The main domain of his research activities has been Palynology in relation to assessment of biodiversity and climate, and role of atmospheric pollen-spore in relation to human respiratory allergy and asthma. Dr. Bhattacharya has contributed significantly in Holocene climatology in Assam, Bengal Basin, and Southern West Bengal. He also made atmospheric pollen-spore calendar of various townships of West Bengal which are found to be helpful to the clinicians for easy diagnosis of pollen-spore allergy. Dr. Bhattacharya also purified and characterize several pollen allergens namely, *Cassia* (3 spp), *Alstonia scholaris*, *Eucalyptus citroidora*, *Madhuca indica*, *Cocos nucifera*, and *Cycas circinalis* - a gymnosperm pollen causing allergy reported first time from India. He has also made significant contribution to the assessment of quality of India honey through melissopalynological and biochemical analyses. Dr. Bhattacharya has guided eleven Ph.D. students and has published around 100 scientific papers / reviews in various impact journals and books, and participated in various national or international conferences/symposia, etc. Dr. Bhattacharya has authored 2 text books and edited one book on 'Current concept on pollen spore research'. He has lectured at

various universities and delivered contributed talks at national and international seminars.

Dr. Bhattacharya is currently President of the Indian Aerobiological Society. He has been elected Fellow of the West Bengal Academy of Science & Technology, Fellow of the Indian College of Allergy, Asthma & Immunology, and Fellow of the Indian Aerobiological Society. He is presently one of the Members of INDSUBIO (Indian Sub-Continent Biomization) Project sponsored by IGBP (International Geosphere Biosphere Programme), Bristol University, UK and was one of the Core Members, GEO Task US09-01a: Earth Observation Priorities for Human Health: Aeroallergens SBA project (Sponsored by NASA). University of North Carolina, USA.



**PROF. APARAJITA OJHA**

**President**

**Section of Information and Communication Science & Technology (including Computer Sciences)**

Professor Aparajita Ojha completed her basic education from R.D. University, Jabalpur. She was the recipient of four gold medals including the University medal for attaining the first rank in M. Sc. Examination across the science disciplines. As a graduate student, she was fascinated by two important areas of



studies; spline approximation and summability theory. As a CSIR Junior Research Fellow, she continued to study the quasiconformal mapping properties of complex planar splines and approximation properties of bivariate splines which led to her Ph.D. degree under the guidance of Professor H.P. Dikshit. It was shown that complex planar splines define a one-to-one onto mapping over their region of interpolation, which strikingly ensured the quasiconformal property. These research findings were published in prestigious Mathematical Proceedings of Cambridge Philosophical Society. Along with Prof. H. P. Dikshit, she also worked jointly with two other well-known mathematicians Professor Ambikeshwar Sharma of University of Alberta, Edmonton, Canada and Professor R.A. Zalik of University of Alabama, Auburn, USA on quasiconformal properties of higher degree rational complex planar splines. Later her research interest was oriented towards computer aided geometric design and geometric modelling. Working on the constructive aspects of finite element methods, Professor Ojha, together with Professor Dikshit and Professor W. Dahmen of RWTH, Germany developed a numerically efficient iterative algorithm for Wachspress quadrilateral elements which could be suitably employed for surface generation and geometric modelling. Later, Professor Dikshit and Professor Ojha jointly developed a novel subdivision formula and smoothness criteria. These important contributions were published as a series of papers in the prestigious journal Computer Aided Geometric Design. She also worked with her student Anita Bhatt on variation diminishing properties of  $n$ -dimensional Bernstein polynomials and established an upper bound on the total variation of these polynomials. Professor Ojha's current research interests include path planning for robotics and gaming,

visual cryptography, data hiding and digital watermarking, motion estimation for digital video processing, network flow optimization and software engineering. Using interesting properties of wavelets, Professor Ojha and her student Amit Kumar have devised a novel technique for natural path planning, suitable for animated characters. They have also studied certain pursuit evasion game problems and are now developing hardware to implement their algorithms.

Starting her teaching career in 1984 as a lecturer in the Department of Mathematics and Computer Science of the R.D. University Jabalpur, Professor Ojha served the university for 21 years in capacity of Reader and Professor also. In December 2005, Professor Ojha moved to PDPM Indian Institute of Information Technology, Design and Manufacturing Jabalpur as a Professor. Since 2009 she has been serving the Institute as the Director.

Professor Ojha is a life member of Several academic societies. Professor Ojha has worked on a number of research projects and has been invited in various national and international conferences for delivering lectures.



**DR. ARVIND KUMAR SAXENA**  
**President**  
**Section of Materials Science**

Dr. Arvind Kumar Saxena did his M.Sc. in Organic Chemistry from University of

Lucknow, Lucknow in 1975. Later on, he was awarded Ph.D. in 1980 from the same university and carried out excellent work in the area of Organometallic Chemistry of main group 14 & 15 as is evidenced with several international publications. As a postdoctoral fellow (PDF), Dr. Saxena worked at Industrial Toxicology Research Centre (Presently named as IITR), Lucknow and has carried out remarkable work in the area of Plastic & Polymer Toxicity.

Dr. Saxena was selected in DRDO through UPSC as Scientist 'C' in 1983 and posted at DMSRDE, Kanpur in April, 1984. Since then Dr. Saxena is continuously serving DMSRDE at various capacity and in 2011 as Scientist 'G', he has assumed the charge of DMSRDE as Director. In 2012 he was promoted to Scientist 'H'.

In DMSRDE, he has carried out pioneer research work in the area of strategically important material & products for which he has been given time to time several awards & recognition but most prestigious award given to him i.e., the DRDO Best Innovation/Futuristic Development Award in 2011 for the development of ceramic precursor materials which will be used as structural material to withstand at very high temperature for Rockets, Missiles, re-entry vehicles, EATERS, Tokomak etc. and will also be required for high temperature semiconducting device, armors, stealth technologies & support materials/products.

He mainly worked in the area of organo silicon & organo phosphorus based Inorganic polymers. The strategically most important material developed under leadership of Dr. Saxena is Polycarbosilane which is a source for all poly types of SiC ceramic. PCS is the only material used for SiC fiber and future candidate for making composites for ultrahigh temperature applications as CFCMC's & CMC's.

Polyphosphazene (PPZ) is also a unique strategic material as it has fire, solvent & UV resistant properties. The PPZ rubber components can be used up to -100 to +250°C and potential candidate for cryogenic application. Under his able leadership the PPZ polymer has been synthesized and its continuous & nano fiber have been developed.

He is Life Member of several academic societies. He is founder President of Society of Polymer Science of India (Kanpur – Lucknow Chapter) and Academy of Microscope Science & Technologies, India. Under his supervision, three students got Ph.D. degree and five students are pursuing research work for Ph.D. degree.

He has published more than 75 papers in Peer Reviewed International journals & filed 30 National & International Patents and transferred the technologies of five products to industries for production.



**PROF. AJAY KUMAR**

**President**

**Section of Mathematical Sciences  
(including Statistics)**

Prof. Ajay Kumar is presently Dean Research (PS & MS) and Head, Department of Mathematics, University of Delhi. His research interest include Operator Spaces, Harmonic Analysis, Representation theory of locally compact groups and hypergroups, Complex

analytic methods in partial differential equations, Potential Theory on Lie groups. He has published several research papers in journals of international repute. He was awarded several foreign post doctoral fellowship like DAAD (German Academic Exchange Service); C.I.E.S. (French Govt. Fellowship); Commonwealth Academic Staff Fellowship; Royal Society, London fellowship; DFG (German Research Foundation); JSPS (Japan Society for Promotion of Science) etc. He has supervised Nine Ph.D. thesis and fifteen M.Phil. dissertations.

He has been teaching in University of Delhi since last 37 years and has visited/worked in more than 25 Universities in the world. He has been Reviewing for Mathematical Reviews and Zentralblatt für Mathematik and has been Referee for several national and international journals. He has organized several National and International conferences and Advance training programmes for Lecturers.



**DR. SHASHI BALA SINGH**

**President**

**Section of Medical Sciences  
(including Physiology)**

Dr. Shashi Bala Singh, Sc 'H' has the distinction of serving in the immensely difficult terrain like Leh- Ladakh. She served as Director, Defence Institute of High Altitude Research (DIHAR), Leh, from 1<sup>st</sup> Sep 2007 to

30 Nov 2010 before taking over as Director, Defence Institute of Physiology and Allied Science (DIPAS), Delhi on 1<sup>st</sup> Dec 2010.

She obtained her Ph.D. degree in Human Physiology from All India Institute of Medical Sciences, New Delhi in 1986 and started her career in DRDO at DIPAS, Delhi. Dr Shashi Bala Singh has substantially contributed towards improvement in the quality of life of the soldiers deployed at high altitudes. Her innovative approach has ensured fresh food availability in the Ladakh sector, which resulted in close interaction between troops and natives providing insulation from security threats to this region. She pioneered research on non-conventional energy sources, permafrost based germplasm conservation, climate change mitigation and development of herbal interventions for improving performance at high altitude. She has developed supplementation with antioxidant and cholinomimetic drugs to improve high altitude induced impairment in cognitive functions. Using behavioral, biochemical and electrophysiological studies, she has showed that impairment in memory function is mainly due to the oxidative stress leading to neuro-degeneration in brain structures (hippocampus, cortex and striatum) involved in learning and memory. Using translational approach, she has facilitated in bringing the research from laboratory to the soldier and society. Her contributions have helped in building technologies and products that help in modulating the microclimate of soldier thus providing habitability in difficult terrains.

She was conferred the "Scientist of the Year Award" by Hon'ble Prime Minister in 2010. She is also the recipient of Surg Rear Admiral M.S Molhotra Prize-2012 & 2007, CSIR Award for S&T Innovations for Rural Development-2011, Marico Innovation Award-

2010, Titanium Trophy-2009, DRDO Scientist of the year Award-2009, Technology Spin off award-2008, Prof. Baldev Singh Oration award-2007, DRDO Laboratory Scientist of the year Award-2006, Dr JN Maitra Memorial Oration Award-2003 and Bharat Nirman Talented Ladies Award-1995 amongst the various awards and honors to her credit. She also has more than 100 publications in national and international journals.

Dr. Shashi Bala Singh is the Fellow of National Academy of Sciences, India (FNASc), President of Federation of Indian Physiological Societies (FIPS), Jury Member of Marico Innovation Foundation Awards, member of the Academic Council of the Central University of Tamil Nadu (CUTN), Member of the Project review committee of National Innovation Foundation (NIF), Academic Board member of Sri Ram Institute of Industrial Research. She is a Fellow of Indian Association of Biomedical Scientists (FIABMS) and Indian Academy of Neuroscience (FIAN). She is also Editor of Journal of Biomedicine (Physiology section) and Annals of Neuroscience.



**DR. SIB SANKAR ROY**

**President**

**Section of New Biology (including Biochemistry, Biophysics & Molecular Biology and Biotechnology)**

Dr. Sib Sankar Roy is working as Principal

Scientist at the Cell Biology and Physiology Division, CSIR Indian Institute of Chemical Biology, Kolkata. Dr. Roy passed M.Sc. in Life Science in 1990 from Visva Bharati, Santiniketan and then joined at Department of Biochemistry, Bose Institute to for his Ph.D. degree in 1991. He submitted his Ph.D. thesis in 1996 and awarded degree from Jadavpur University. He did his Post-Doctoral work at Harvard School of Public Health, Boston, USA and joined at this Institute in the year 2000 and started working on molecular mechanisms of metabolic disorders.

Dr. Sib Sankar Roy's long term research interest is to understand the mechanisms of metabolic disorders considering two critical diseases like diabetes and cancer. Ovarian cancer is considered as the second largest gynaecological cancer type and its mechanism of pathophysiology is not known and its early diagnosis remains a challenge. He made significant contribution in understanding the mechanisms of proliferation/invasion of ovarian cancer cells. While VEGF's role is well-known in endothelial cells, for the first time his group demonstrated that VEGF binds to its receptor in ovarian epithelial cancer cell. Through MAPK pathway, VEGF activates Ets-1, which up-regulates MMPs important for cancer cell invasion. He identified a novel growth factor (FGF-16) that augments proliferation/invasion of ovarian cancer cells and could be a promising future drug-target and detection marker for ovarian cancer. Dr. Roy works for many years in transcriptional regulation of key genes regulating ovarian structure/function in normal and diseased condition. He showed how collagen metabolism is controlled in ovary by PITX2 homeodomain transcription factor, which regulates the expression of many important genes in ovary that are pertinent to

cancer progression. In addition, he has established that Wnt signalling pathway and PITX2 interacts in ovarian cancer cells and a positive feedback loop controls the cellular growth and proliferation. He has contributed extensively on the mechanism of insulin resistance and diabetes type2 and identified carp cell as new source of insulin. Thus, Dr. Roy has extensively investigated and identified and characterized the factors to understand the mechanism of critical metabolic disorders.

Dr. Roy published about 26 research papers in highly reputed International journals and got three patents. He also wrote 2 chapters in two books. Till now nine students received Ph.D. under his guidance from Jadavpur University and University of Calcutta and eight students are presently working under him for Ph.D. degree. He has received many awards like CSIR Raman Fellowship and elected Fellow of West Bengal Academy of Science and Technology. Dr. Roy delivered invited talks in conferences and seminars in many National and International venues. Along with his research activities, he teaches at various Universities as visiting teachers.



**PROF. V. P. MAHADEVAN PILLAI**  
**President**  
**Section of Physical Sciences**

Dr. V.P. Mahadevan Pillai is Professor and Head of the Department of Optoelectronics in

the University of Kerala, Thiruvananthapuram, Kerala, India. He has been the Dean of Faculty of Applied Science and Technology of the University of Kerala from 2011 onwards. He was born in 1959. He took B. Sc., M.Sc., M.Phil. and Ph.D. Degrees from the University of Kerala. He started his career as lecturer in 1982 in the Department of Physics of the St. Gregorios College, Kottarakara, Kollam District, Kerala. He was promoted Reader of Physics in 1996. He continued in that post until he got appointment in 2001 as Reader in the Department of Optoelectronics in the University of Kerala, Thiruvananthapuram. He was promoted as Professor of Optoelectronics in 2005. From June 2001 onwards he is the Head of the Department.

He is working in different research areas including spectroscopy, laser technology, holography and nanophotonic materials. He has successfully guided 14 Ph. D. scholars and 44 M. Phil. dissertations. He has also guided several M. Tech. dissertations. He has published around 120 research papers in peer reviewed international journals which have received more than 700 citations. He has more than 200 papers which were accepted/presented at International/National Conferences. He has delivered over 45 invited talks in International /National Conferences. He is the Chairman of the Board of Studies in Optoelectronics, and Member of the Academic Council and Faculty of Applied Science and Technology of the University of Kerala since 2002. He is/was member of Board of Studies in various Universities *viz.*, Periyar University (Salem, Tamil Nadu), Cochin University of Science & Technology (Kochi), Pt. Ravi Shankar Shukla University (Raipur), Alagappa University (Karaikudi, Tamil Nadu) etc. He

has been awarded the “Catholicate Best Scientist Award” in 2012. He is a Member of the Editorial Board of the Journal of Optics (Springer).

He has served as General Secretary I of the Indian Laser Association for the period 2009-2013. He is a life member of various professional organizations. He was the Local Joint Secretary for the 97<sup>th</sup> Indian Science Congress 2010 held in Thiruvananthapuram and was the Co-Secretary for DAE-BRNS National Laser Symposium (NLS 2002) held in Thiruvananthapuram in 2002. He was the Convener of organizing committee for the conduct of four national conferences. He had visited the Institute of Sensorics and Information Sciences (ISIS), Karlsruhe University of Applied Sciences, Germany (under DAAD fellowship) for two weeks in 2011 and delivered lectures. He had also visited Karlsruhe Institute of Technology. Recently, he visited The Robert Gordon University in Aberdeen, UK as Visiting Professor for two weeks under UGC-UKIERI project and delivered a talk in IDEAS seminar.



**PROF. ARUN KUMAR PANDEY**  
**President**  
**Section of Plant Sciences**

Professor Arun Kumar Pandey (born 1953), received his school to University education at

Lucknow. He obtained M.Sc. Degree from University of Lucknow (1973) and worked for Ph.D. degree at National Botanical Research Institute, Lucknow. He joined the Department of Botany, TM Bhagalpur University, Bhagalpur in 1983 and rose to the position of Professor in 1995. He has taught taxonomy, evolution, reproductive biology and plant resources and supervised doctoral work of 18 scholars. He was selected as Professor of Botany at the University of Delhi in August 2008. Thus he has more than three decades of research and teaching experience.

Prof. Pandey was Post-doctoral Fellow in the Ohio State University, USA during 1987-88. In 1994, he visited Herbarium, Royal Botanic Gardens, Kew, England. In 2002 and 2004, twice he was awarded Bass Fellowship of the Field Museum Chicago, USA where he worked on molecular taxonomy of the ginseng family. He was Visiting Professor at the University of Vienna, Austria (2006) and INSA visiting Fellow at the Korea Research Institute of Bioscience & Biotechnology (2008). He has delivered invited lectures at the University of Munich, Begning and Vienna.

Prof. Pandey has carried out extensive research on the systematics and reproductive biology of families such as Asteraceae, Cucurbitaceae, Araliaceae and Fabaceae. He has done taxonomic revision of *Tricholepis*, *Inula*, *Aralia* and *Panax*. He has published an exhaustive checklist of Indian Cucurbitaceae and papers on molecular phylogeny of *Aralia-Panax* complex (Araliaceae), *Nassauvia* (Asteraceae), *Crotalaria* and *Indigofera* (Fabaceae). He has published a new species, *Indigofera himachalensis* from Himachal

Pradesh. Ethnobotanical studies carried out by him have helped to record important, useful traditional knowledge from among different tribal groups in Santhal Paragana (Jharkhand), Similipal (Odisha) and Chothe tribe (Manipur). Dr Pandey has carried out extensive work on medicinal plant wealth of Similipal Biosphere Reserve (Odisha), and on impact of mining on the flora of Rajmahal hills (Jharkhand).

Prof. Pandey is recipient of YS Murty medal of the Indian Botanical Society and VV Sivarajan medal of the Indian Association for Angiosperm Taxonomy. He has delivered G. Panigrahi Memorial lecture (2009) at University of Kuvempu (Karnataka) and Parukutty Barua Memorial Lecture (Gauhati) in 2006. Dr. Pandey is President of East-Himalayan Society for Spermatophyte Taxonomy (EHSST) and Past President (2010) of the Indian Association for Angiosperm Taxonomy (IAAT). He is Past Recorder of the Plant Science Section of ISCA.

He has published over 140 research papers and has authored 14 books. Professor Pandey is member/ office bearer of 16 national and international societies. He has completed 16 major research projects and has organized International symposia, Taxonomy training and Orientation programmes, Workshops on Ethnobotany and Molecular systematics. He was twice Organizing Secretary of the Indian Association for Angiosperm Taxonomy and was Executive Editor of *Rheedea* (official journal of IAAT) during 1999-2000. He is Professor-in-charge of the Delhi University Herbarium (DUH) and the Botanical Garden of the Department of Botany.



**DR. K. G. MANDAL**

**Recorder**

**Section of Agriculture and Forestry Sciences**

Dr. Krishna Gopal Mandal is presently a Senior Scientist (Agronomy) at the Directorate of Water Management (ICAR), Bhubaneswar. Born at Kumardubi in Bankura district of West Bengal in 1967; educated at Bishnupur High School; B.Sc. (Ag) Hons. with 1<sup>st</sup> Class First & M.Sc. (Ag) with 1<sup>st</sup> Class First, Faculty Topper from Institute of Agriculture, Visva-Bharati, Sriniketan 1987-91 & 1991-93; Ph.D. in Agronomy from BCKV, West Bengal 1994-1997; Post-Doctoral research from CAU at Beijing 2005-06. Dr. Mandal started his research career as ARS Scientist 1998-02, then Scientist (SS) 2002-07 in the discipline of Agronomy at IISS (ICAR), Bhopal. Since 2007, he is engaged in research and training as Senior Scientist at the present institute.

He has more than 16 years of research experience in ICAR on soil & plant nutrient management, irrigation, watershed management, conservation tillage and energy management in about 12 institutional/ inter-institutional (ICAR funded), and 6 external funded Agencies. Dr. Mandal has significant contribution in integrated nutrient management, water x nutrient interactions, development of water production functions,

energy efficiency, crop diversification on broad-bed and furrow land configuration, conservation tillage for soybean-wheat system, water stress physiology and mitigation strategies, nutrient starvation and root growth, irrigation water saving techniques, soil organic carbon assessment in cropping systems, pedotransfer functions, on-farm water management, agronomy of aerobic rice, improving water productivity in canal commands and pond-based integrated farming systems.

Dr. Mandal is also involved in guiding students for thesis work and training at the present institute. He was the Coordinator/Convener and resource person for several Farmers' and Trainers' Training Programmes. He is also involved as a resource person for several model training & short courses, summer & winter schools organized at the Institute, dissemination of technologies through exhibition and farmers' fair organized by the State and Central Govt. Departments.

Dr. Mandal has very good publications with 58 research papers (32 international, 26 national), 13 books/ book chapters. Dr. Mandal has received National Scholarship of the GoI, S.J. Jindal Trust Scholarship, Dr. Amitava Mukhopadhyay Memorial Gold Medal Award, Hon'ble Prime Minister's Invitation as a Topper, Tapan Memorial Award (twice) 1991 & 1993; University Research Fellowship of BCKV; ICRISAT Sr. Research Fellowship; CSC Chinese Govt. Scholarship 2005-06; Doreen Mashler Award 2006 of ICRISAT; DWM (ICAR) Proficiency (Scientist) Award 2011. He is the Life Member of several professional societies and editorial board member of 3 journals. He was recently associated with ISCA as a Sectional Member for the years 2012-14.



**PROF. KALYANI PANDEY**

**Recorder**

**Section of Animal, Veterinary and Fishery Sciences**

Dr. Kalyani Pandey, M. Sc., Ph. D., FZSI, Professor & Head of Zoology, MRM College, Darbhanga has worked on different aspects of Fish Biology and Environmental Science. She has published over 45 research papers in reputed journals and supervised four Ph. D. students. She has worked as Principal Investigator of UGC funded research projects. She is Member/Life Member and Fellow of many professional bodies and recipient of many honours/awards including ZSI Gold Medal. She has the honour to cochair many seminars/symposia. Her research articles have been cited in many books.



**DR. RAKESH K. SRIVASTAVA**

**Recorder**

**Section of Anthropological and Behavioural Sciences (including Archaeology, Psychology, Education and Military Sciences)**



Dr. Rakesh K. Srivastava (born Feb. 15, 1953) is presently Head. Department of Psychology, Post-Graduate College, Malikpura, Ghazipur (U.P.) of the V.B.S. Purvanchal University since 1979. He earned his M.A. (1973) and Ph.D. degree in Psychology (1979) from Kanpur University, Kanpur. Earlier he served in research projects at I.I.T. Kanpur and I.I.M. Ahmedabad and teaching and research assignments at P.P.N. College, Kanpur. Dr. Srivastava has contributed more than 50 scholarly articles in Indian and foreign journals. He has published seven book chapters, two books reviews, two test adaptations and also completed three research projects funded by the University Grants Commission. He is also supervising Ph.D. level research in Psychology. He has done extensive research on tribals particularly on Ethnic Psychology of Tharu tribals. He is currently working in the areas of Psychology of acculturation, Ethnic Socialization. Empowerment of tribals, Cross-cultural issues in human development and Indigenization of psychology in India.

He is a member of several Indian and foreign professional associations. He was also a member of International Council of Psychologists, U.S.A. (1981-82). He was founder member and Joint Secretary of Community Psychology Association of India (1988-2001), Executive member of Praachi Psycho-cultural Research Association (2001-05), and Executive member of Indian Psychological Association (1993-94). He has been an Executive member of Uttar Pradesh Psychology Association since 1995 and also a member of Research Board of Advisors (since 2000) of the American Biographical Institute (U.S.A.). He has been nominated as one of the members of the 27 member international

operational group of the World Association of Cultural Psychiatry (WACP). He is awarded IPERA Prof. M.A. Hakim Memorial award for the best Applied Psychologist (2013) at 1<sup>st</sup> IPERA International Conference and also awarded Indian Psychological Association President's Gold Medal and certificate for excellence in Psychology (2014). He was an Associate Editor of *Purvanchal Journal of Social Sciences* (1993-94). He has attended more than 75 National and International conferences.

Dr. Srivastava was an elected Sectional committee member of Section of Psychology & Educational Sciences (82<sup>nd</sup> Session, 1994-95) and Section of Anthropological & Behavioral Sciences (90<sup>th</sup> session, 2002-03 & 95<sup>th</sup> session, 2007-08). He has also served as Chairperson/Rapporteur at different conferences. Presently he is the member of the editorial boards of several journals of psychology and social sciences including Indo-Indian Journal of Social Sciences and Behavioral Research Review. He has visited various Universities in India and Abroad.



**DR. RANJANA AGGARWAL**  
**Recorder**  
**Section of Chemical Sciences**

Dr. Ranjana Aggarwal (September 20, 1967)  
Professor, Department of Chemistry,

Kurukshetra University Kurukshetra obtained her M.Sc. (with distinction, 1988) and Ph.D. (1992) from Kurukshetra University. In 1992, she visited Cambridge University, UK as a postdoctoral fellow where she worked in the area of biosynthesis of erythromycin with Prof James Staunton, FRS. Subsequently, she joined Kurukshetra University as a faculty in 1995 and is actively engaged in teaching and research with more than 20 years of experience. Dr. Aggarwal was awarded Commonwealth Fellowship in 2003 to work again at Cambridge University in Dr. Spencer's group on enantioselective synthesis of aminolactones. She was a visiting fellow at Trieste University, Italy and worked on antibody catalysis.

Her research work is mainly focused on developing green synthetic methodologies for regioselective synthesis of heterocycles of natural and synthetic origins. Commonly employed methodologies involve: mechanochemistry, multicomponent reactions and eco-friendly hypervalent iodine reagents. The bioactiveazole compounds have been identified as selective antitumor compounds acting as photonucleases, minor groove binders and caspase inhibitors. 2D NMR spectroscopy and computational modelling are being explored to assign isomers of fluorinated and non-fluorinated compounds without any ambiguity.

She has completed five major research projects till now. Recently, she was awarded an International collaborative research project on development of anticancer agents under India Ireland Cooperative Science Programme by DST, New Delhi and Trinity College Dublin, Ireland. So far, eight students have obtained their Ph.D. degree under her supervision. She has published more than eighty research papers in the National and International

journal with high impact factor. She has delivered many invited talks and plenary lectures at various conferences and Institutes/Universities both in India and abroad.

Besides chemistry as her academic discipline, Dr. Aggarwal is actively engaged in issues related to women empowerment. She is a resource person and Master trainer for Sensitization, Awareness and Motivation (SAM) programme for Women in Higher Education, a drive of UGC, initiated by Prof. Armitry Desai, former Chairperson UGC. She is Member and Councillor of Gender Sensitization Committee against Sexual Harassment at workplace of Kurukshetra University and other state Universities.



**PROF. PANKAJ K. SRIVASTAVA**  
**Recorder**  
**Section of Earth System Sciences**

Born in the year 1966, Prof Srivastava has obtained his Ph.D. degree in Applied Geology from Indian School of Mines Dhanbad in the year 1991. At present he is working as Professor of Economic Geology and Dean Students Welfare in the University of Jammu. Prof Srivastava has served different organizations like Wadia Institute of Himalayan Geology, Dehradun, and University of Rajasthan, Jaipur in different capacities before finally joining University of Jammu. He has more than 22 years of Teaching and Research experience in the field of Ore Geology, Mineral Exploration,

Mining Geology, Fluid Inclusions and Geochemistry.

The main area of his research work involves genesis of hydrothermal mineral deposits with the help of fluid inclusion and geochemical techniques. Tungsten and rare metal deposits associated with acid magmatism are of special interest to me. Apart from this the gold deposits of Mahakoshal belt, gem bearing pegmatites, fluorite deposits of Rajasthan, and carbonate hosted Pb-Zn and Himalayan magnesite deposits have also been studied particularly with reference to evolution of ore bearing fluids and genesis of these deposits. Five research projects and a number of technical consultancies have been completed till date.

He has 45 refereed publications in scientific International and National journals and 4 edited books. He has presented more than 75 papers presented in different international and national seminars.

Dr. Srivastava is DAAD Fellow and has received a number of fellowships from different organizations. He was the Convener of Children Science Congress in the 101<sup>st</sup> session of the Indian Science Congress held at Jammu in 2014.



**DR. TAPAS LAHA**  
**Recorder**

**Section of Engineering Sciences**

Dr. Tapas Laha presently holds the position

of assistant professor in the Department of Metallurgical & Materials Engineering at Indian Institute of Technology Kharagpur. Born on July 07, 1978, Dr. Laha obtained his B.E. degree from Indian Institute of Engineering Science and Technology (IEST), Shibpur (formerly Bengal Engineering College) in 1999 and M. Tech. from IIT Kanpur in 2002. Dr. Laha received his Ph.D. in 2006 from Florida International University (FIU), Miami, USA in the area of nano-fiber reinforced metallic nanocomposites.

As a young researcher, Dr. Laha is currently involved in synthesis/development and mechanics of carbon nanotube reinforced bulk metallic nanocomposites for structure application. The processing routes being adopted for the synthesis of these nanocomposites are thermal spraying, spark plasma sintering (SPS) and microwave sintering (MWS). Dr. Laha is trying to address the very significant and fundamental issues of "interface engineering of CNT" to promote the bonding between CNT reinforcement and metal matrix in his work.

Another research area, which Dr. Laha is exploring presently, is synthesis of Al based bulk metallic glass nanocomposite (BMG-NC) via mechanical alloying and spark plasma sintering (SPS). In this work, Dr. Laha is focusing to improve the ductility and fracture toughness of intrinsically brittle Al based BMGs by reinforcing this material with ductile crystalline reinforcement. Dr. Laha is also working in the area of surface engineering and coating, where investigating the tribological behaviour and interfacial phenomena in layered nanocomposite is the primary focus. He is involved in an industrial

problem of steel-rubber interfacial adhesion improvement, addressed this issue by developing a novel multi-layer Cu-Sn coating strategy and published 5 technical papers in peer-reviewed international journals based on this work.

Dr. Laha has published total 36 research papers in peer-reviewed journal and conference proceedings and presented around 40 technical talks in national and international conferences based on his research work. He has received the "IEI Young Engineers Award 2010-2011", in Metallurgical & Materials Engineering discipline, given by the Institution of Engineers, India. He was also awarded "The Outstanding Ph.D. Graduate, Fall 2006" from College of Engineering and Computing, Florida International University after completion of his Ph.D. degree. Dr. Laha is involved with review work in various international journals and was selected twice as the "Top 20% reviewer" by Metallurgical & Materials Transactions. Dr. Laha is active member in various professional societies.



**MAITREE GOPAL TIWARI**  
**Recorder**  
**Section of Environmental**  
**Sciences**

Maitree Gopal Tiwari was born on 15<sup>th</sup> December, 1982 in Deoghar, Jharkhand. She

completed her B.Sc. (Botany Hons.) from SKM University, Dumka, Jharkhand. Later on she did her M.Sc. and B.Ed. from Visva-Bharati University, Santiniketan, West Bengal. She pursued her M. Phil degree at Rani Durgawati University, Jabalpur, Madhya Pradesh and was an integral part of the Mycological Research laboratory. She conducted her research in Plant breeding and Genetics in Horticulture from Oregon State University, Corvallis, OR, USA.

She has research experience in diverse fields of Life Sciences and extremely motivated towards recent developments in this area. For her master's degree, she chose environmental biology and pollution with special focus on "Jatropha for Biodiesel Production." Based on the results obtained by growing the shrub on different types of soils, it was established that Jatropha could be cultivated on the dry barren wastelands without the use of fertilizers. This could solve the shortage of fossil fuel issue as well as address the worsening pollution situation in India.

For her M.Phil project, she worked on, "Gelatin Zymography as a criterion in identification of *Chrysosporium* species." For the first time, Gelatin Zymography was used to identify species of *Chrysosporium*. She has several publications in different national journals and conference proceedings. After qualifying GRE and TOEFL, she went to USA for higher studies. There, she joined the graduate program in Horticulture Department at Oregon State University (OSU), Corvallis. She was working on Genetic Mapping for resistance to root rot disease in snap beans under vegetable breeding program. She has strong inclination towards nature and believes sustainable agricultural and human

development. In her future research, she wants to apply new techniques of molecular biology in ecological studies.



**PROF. ARUN D. GANGARDE**  
**Recorder**  
**Section of Information and Communication Science & Technology (including Computer Sciences)**

Prof. Arun Gangarde , MCS, MCM, MBA from Pune university. At Present Working as Chairman, Board of Studies in Animation, University of Pune and working as a Associate Professor & Head, Postgraduate Department of MCA New Arts, Commerce & Science College, Ahmednagar (M.S.). He has contributed as an Expert, Observer, Convener in various committees of university. He is member of Board of Studies, Research Committee & Academic Council of Pune University and worked as External Evaluator and / or Visiting Faculty of many colleges, Universities & Institutes., participated in Designing & Implementation of Computer & IT related course curriculum for various Universities & Institutes, conducted many development programs for the students of different faculties in affiliated colleges, organized and / or participated in National & International Conferences and Seminars,

presided Technical sessions and delivered lectures in them.

Worked as Co-ordinator for National Conference & faculty development program at college level. Joint Secretary of Yashwantrao Chavan Vyaspeeth, (Public Trust) at Ahmednagar engaged in social & educational reforms. Life member of various Professional & Technical societies. Being a professional in computer science and Information Technology Since last 24 years, he has worked in various application areas of the related field in terms of research, consultancy and Project Development. About 24 years of Experience in Teaching, Training and Research in the field of Computer Science & Information Technology. Pioneer in Animation degree in Pune university Education by introducing B.Sc. (Animation) course under faculty of science, the 1<sup>st</sup> under graduate level Education in the state of Maharashtra.



**DR. ASHISH KUMAR**  
**Recorder**  
**Section of Materials Science**

Dr. Ashish Kumar obtained his M.Sc. Degree in 1995. After qualifying CSIR-UGC NET in 1999, he was awarded PhD in 2004 for his thesis on river water pollution. He started his teaching career in 1997. Since 2003 he is

working as asst. Prof. Chemistry in Agra College (one of the oldest educational institutions in India established in 1823). His research interests include various aspects of water pollution. He has presented numerous papers at various national and international conferences. He has several research papers in national and international journals to his credit. In 2007, he visited University of California, Santa Barbara among other places in U.S.A. as the member of Group Study Exchange team.

This year he was selected for Netherlands Fellowship Programme. Under this he was awarded scholarship to attend a course on water quality assessment at UNESCO-IHE (The Netherlands), which is one of the world's best institutions on water education. He is the only candidate selected for this prestigious scholarship for this course from India this year. Apart from above he has visited several countries in four continents.



**DR. RASHMI VERMA**

**Recorder**

**Section of Mathematical Sciences  
(including Statistics)**

Dr. Rashmi Verma did her B.Sc.(Hons.) in Mathematics, M.Sc. in Mathematics, M.Phil. in Mathematics and Ph.D. in Mathematics

from University of Delhi in 1999, 2002, 2004 and 2010 respectively. She has to her credit several research papers published in national and international journals. Her research interest is in Algebraic Coding Theory. She is recipient of Shri Suresh Bhatia Memorial Gold Medal (1999), Rai Bahadur Brijmohan Lal Saheb Memorial Gold Medal (1999) and Dr. J.N. Mitra Memorial Prize (1999) for being the best candidate in B.Sc.(Hons.) in Mathematics. She was shortlisted for Young Scientist Award in the Section of Mathematical Sciences (including Statistics) of 96th Indian Science Congress 2008 - 2009. She has been a member of the Jury of INSPIRE AWARD (DST program) at National Level Exhibition and Project Competition (NLEPC) held in 2012 and 2013 at New Delhi. She has participated in several national and international conferences/seminars. She is currently an Assistant Professor in the Department of Mathematics at Mata Sundri College for Women (University of Delhi).



**DR. SAMIR KUMAR SIL**

**Recorder**

**Section of Medical Sciences  
(including Physiology)**

Dr. Samir Kumar Sil, did his B.Sc. (M.B.B.College, Agartala) and M.Sc. in Physiology from University of Calcutta. He

did M.Sc. in the year 1988 with first class third position and qualified CSIR/UGC NET in 1989. He carried out his Ph.D. in the Department of Human Genetics, Indian Statistical Institute, Kolkata on Haemoglobin related genetic disorder and Genomic analysis. Using autosomal and mitochondrial polymorphic DNA markers Dr. Sil deciphered the origin of tribal population of Tripura from genetic point of view. Afterwards, he visited Tulane University, USA, to work on Haemoglobin E, haemoglobinopathy predominantly found in northeastern populations, and malaria.

He joined Tripura University in 1995 and at present he is the Head of the Department of Human Physiology, Tripura University. His research interest revolves around genetic polymorphism and disease susceptibility. Analyzing the sequence of HbV genome, their group has identified a new subtype of HBV circulating in the population of Tripura, with clinical implications. His group is also carrying out molecular typing of HPV in cervical cancer patients of Tripura and to decipher the association of host factors with the disease, genome wide association study in respect to different stages of cervical cancer is also being carried out. Another interest of his group is to assess anti-cancer, immunomodulatory and wound healing activity of molecules from natural sources especially from medicinal plants at molecular and cellular level. Using different cell lines (in-vitro) and in-vivo mouse models two endogenous medicinal plants, *P. Javanica* and *E. nummularius*, have been identified to possess anti cancer activity and were found to induce apoptosis in cancer cells involving mitochondria. Up or down

reregulation of components of signal pathways in drug induced fibroblast proliferation is of active interest.

Dr. Sil is a member of different academic bodies and scientific organizations. He is recipient of many honours, awards and fellowships including ICMR Young Biomedical Scientist award and Overseas Associateship by Department of Biotechnology, Govt. of India. He has published his findings in national and international journals.



**DR. PARTHA PRATIM BOSE**

**Recorder**

**Section of New Biology (including Biochemistry, Biophysics & Molecular Biology And Biotechnology)**

Dr. Partha Pratim Bose got his Ph.D in Chemistry from Jadavpur University, Kolakata (2007). He had worked in various renowned universities and institutes like Uppsala University, Karolinska Institute, Sweden; European Institute of Chemistry and Biology, France as post doctoral researcher. In his current assignment, he works as assistant professor in the Department of Biotechnology, National Institute of Pharmaceutical Education and Research, Hajipur. His current research interest is the development of point of care

diagnostic platform based on nanotechnological approach.



**PROF. MANISHA GUPTA**  
**Recorder**  
**Section of Physical Sciences**

Prof. Manisha Gupta, born on Jan 6, 1966, received her college to university education in Lucknow. She obtained her graduate, master's and doctorate degree in 1983, 1985 and 1990 respectively from the University of Lucknow, Lucknow. Prof. Gupta joined the department of Physics as Lecturer in 1990 and rose to the position of Professor in 2007.

Prof. Gupta started her research career as JRF (UGC) in 1985 in the department of Physics, University of Lucknow, Lucknow. She has over 25 years research and teaching experience. Her field of research specialization is electrical, acoustical and spectroscopic studies of materials especially industrially important polymers. Prof. Gupta has vast experience of teaching and research having guided 12 students for Ph.D. and evaluated doctoral work of many Ph.D. scholars. She has also supervised several Master's students for their project work. She has national collaboration as well as inter departmental collaboration within the University.

Prof. Gupta has more than 100 research papers to her credit in various National and

International peer reviewed journals. She is also reviewer of a number of high impact International journals. She has edited several books/proceedings. She has participated in various National and International conferences and chaired various technical sessions and delivered many invited talks. She has also presented papers in Paris (France) and Dubai (UAE). She has successfully completed major research project. She has received Best Poster presentation award in the section of Physics at 90<sup>th</sup> Indian Science Congress, Jan 2003. She had also served several times as sectional committee member in then Physics / Physical Science section.

Prof. Gupta has also administrative experience as Proctor-in-Charge, Additional Proctor, Coordinator, Treasurer, member of several committees in the University. She has been on the selection Committee for appointments in several Universities. She is Life member of various National Scientific bodies.



**PROF. (MRS.) SESHU LAVANIA**  
**Recorder**  
**Section of Plant Sciences**

Professor (Mrs.) Seshu Lavania M.Sc., M.Phil., Ph.D., MNASc, FBS, FLS (London) did her M.Sc., M.Phil. and Ph.D. from Institute of Advanced Studies, Meerut University,



Meerut. She joined NBRI, Lucknow for her CSIR Post Doctoral Fellowship. Later in 1985 she joined as regular faculty in the department of Botany at Lucknow University, Lucknow.

She has 35 years of research experience and published 37 research papers in Indexed Journals and one US Patent. She made significant contributions in the area of floral / vegetative morphology and polyploidy of plants from phenomics and developmental biology angle. Her notable contributions are : (i) identification of an intermediary unique form of axio-parietal placentation in *Solanum grandiflorum* providing unique link *vis-à-vis* placental specialization, (ii) elucidation of evolutionary significance of trichomes in delineating speciation and microtaxonomic

characterization, (iii) experimental strategy for elicitation of bud-sport formation for mining of de novo diversity, (iv) development of root ideotype concept for vetiver for its dual utilization for industrial and environmental applications, including root-anatomy bioassay, (v) proposition of 'vetiver grass model' for carbon sequestration in sub-soil horizon, (vi) demonstration of 'polyploid model' for fixation of heterozygosity, and (vii) pinpointing that native secondary metabolites in progenitor diploids have decisive bearing on growth behavior in the derived autopolyploids in grasses (*Cymbopogon* Sp.). She is a recipient of Woman Scientist Medal of Indian Botanical Society, King of Thailand Vetiver Award Certificate of Excellence and Vetiver Network International Certificate of Excellence.

## KNOW THY INSTITUTIONS



NATIONAL ATLAS AND THEMATIC MAPPING ORGANISATION (NATMO), KOLKATA

National Atlas & Thematic Mapping Organisation (NATMO), a subordinate office under Department of Science & Technology, Govt. of India, is the sole authority of depicting National framework data in the form of thematic maps and atlases to cater the actual picture of the development and planning initiatives of the country among the users. Keeping pace with the modern-state-of-the-art technologies and also to achieve the goal as per its mission to the path forward in the arena of geo-spatial technologies, NATMO has already progressed a lot in its axis in respect of both, the vertical growth of user base and demands. It is an opportunity as well as the responsibility to NATMO to reach the most of the citizens of our country to educate and

make them aware of the different aspects of development and plan in the path forward of our country through pictorial projection of thematic mapping and also in electronic (digital) form in Hindi and in all regional languages. The main objective of NATMO is to educate the people of India and to make them conscious about the changing scenario of the physiographic, hydrologic, climatic, administrative, political, social, agricultural, industrial, cultural and economic changes in the country. The Organization motivates the planners and decision makers to use maps as complimentary documents for developmental planning at national, state/ UT, district, sub-division and even at block level. NATMO is also the pioneer of Urban Mapping in India.

Using high resolution satellite data rectified by GPS recordings, large scale city maps are being prepared with detailed information collected from field survey. To promote tourism, industry, tourist atlases, maps, trekking route maps, maps showing the detailed plan/information on national parks and wild life sanctuaries, etc. are being prepared and also being updated on regular basis.

## BACKGROUND

The plan of compiling a National Atlas of India was formulated for the first time in this country by Prof. S.P.Chatterjee, the then Professor of Geography, Calcutta University. A discussion on this subject with late Pandit Jawaharlal Nehru in 1953 resulted in his instant approval of the project. The then Ministry of Natural Resources & Scientific Research after consultations with other Ministries decided to set up an Advisory Board in March 1954 for formulating a scheme for preparation of National Atlas of India. The Advisory Board gave a favourable report and also provided a tentative guide line about the scope and contents of the atlas. Subsequently in April 1954 the same Ministry sanctioned a skeleton staff of 7 posts on a temporary basis to help Professor S.P.Chatterjee in giving shape to the Board's suggestions.

The small group of workers officially known as National Atlas Unit drafted maps on various topics for the proposed atlas. These were examined by different experts in Planning Commission and in the Ministries. The authorities were eventually impressed and convinced about the essentiality of the project and on August 18, 1956 an order from the Government of India issued by the Ministry of N.R. & S.R. sanctioning a budget grant of Rs. 12.43 lakhs for 1956-57 was received. The order also sanctioned creation of additional 56

temporary posts and Prof. S.P.Chatterjee was appointed as the Honorary Director of the Project. The institution thus created was named National Atlas Organisation from that date. The Geography Department of the Calcutta University located at Senate House in those days provided the first shelter to the Organisation.

It grew in strength in the successive plan periods and took up projects of great national importance. The Government appointed a Review Committee in December 1975 under Chairmanship of Prof. George Kurian and as per recommendation of the Committee, the Department of Science and Technology through an order dated 9th August 1978, modified the name of the Organisation as "National Atlas and Thematic Mapping Organisation (NATMO)".

The total strength of the Organisation is now 322 persons who are engaged in scientific pursuits for thematic mapping at local, regional, national & international levels. It employs a large number of highly qualified professional geographers, perhaps largest under one roof anywhere in the world.

## TECHNOLOGY DEVELOPMENT PROGRAMMES

### (a) Brail & Low Vision Mapping :

NATMO has pioneered in the field of mapping of Braille Atlas and atlas for people having low vision. In this project maps and atlases are being prepared using the technology of Braille. For low vision people colour scheme has been chosen suitable for them.

### (b) Large-Scale Mapping :

In this cyber age, availability and accessibility of accurate and reliable information (both micro and macro level) with geospatial solutions, plays a pivotal role in

planning and implementation of national policies in respect of natural resources and management. Effective use of geospatial information and technology has become the platform of solution for different environmental and developmental challenges. But due to absence of high-resolution map data in appropriate forms, many planning and development programme are lagging behind in our country. NATMO has taken initiative for preparation of large-scale maps (1:10,000 scale) on various themes to facilitate micro-level planning like irrigation, agriculture etc. using its own database and technical methodology.

#### (c) District Planning Map Series (DPMS)

##### Initiative :

As per the decision of DCUSPC, NATMO has been assigned this project by DST in the year 1992 and work on the same had been initiated in the year 2002 after formulating the detailed specification. Though this project was shared between NATMO and Survey of India initially, but later on NATMO has been assigned this project solely.

##### Objective :

To provide a ready-reckoner to the planners, researchers, students in respect of complete geographical, geological, geomorphological, demographic, cultural information and features along with administrative boundary, blocks, speciality, etc. of a particular district both in paper format and in digitized format both in Hindi and English.

##### Achievement :

NATMO has almost completed the project and maps of 260 districts have been published for the users. Digital version of the maps are also going on in the final stage and will be

published for the users very soon. However, revision and updation work on account of formation of new districts, are in progress along with the rest project.

#### (d) Golden Map Service (GMS)

##### Initiative :

Accumulating the cartographic base, generated in pieces over the years under several projects, and with the help of the remote sensing data, now available under the Indian Remote Sensing Satellites (IRS) series, particularly the panchromatic data of IRS 1C, 1D and P5 along with the recently launched Cartosat-1 & 2, (the resolution has come to 5.8 and 2.5 metres and 1 metre), NATMO has been taken up this project of Golden Map Service with the following objectives

##### Objective :

- (a) *Primary* : To provide location maps of any site of the country in black and white on web either by place-names or by geographical co-ordinates.
- (b) *Secondary* : To provide route maps between two points in the country.
- (c) *Tertiary* : To provide a basis for a variety of social, economic, administrative operations related to elections, crime, rural marketing, relief and supply etc.

##### Achievement :

NATMO has almost completed site selection for GCP for adjustment of GPS data covering whole of the country. State/Region wise field survey has been going on in the final stage. GMS-Kolkata, GMS-Mahakashi, GMS-Mysore, GMS-Sylvassa, GMS-Gorakhpur, GMS-Bharatpur have been published in Thematic Map (paper print) format during this year. Conversion and patterning of the digital format is going on.

**(e) National Atlas of India****Initiative :**

In the year 1956, the then Prime Minister of India, Pundit Jawaharlal Nehru approved the formation of National Atlas & Thematic Mapping Organisation (then it was National Atlas Organisation) and granted the 'National Atlas Project' to NATMO. Hence, National Atlas is the flagship publication of NATMO. Accordingly 'Bharat Rashtriya Atlas' first published in the year 1957 and its English Version, 'National Atlas of India' was published in the year 1986. Since, then this publication is being updated and revised keeping pace with the administrative changes in respect of states, districts etc.

**Objective :**

- (i) To have India's National Atlas like the other countries of the world.
- (ii) To depict the country in respect of its geology, geography, geomorphology, demography, culture, administration, etc. in thematic map form.

**Achievement :**

National Atlas of India, both in English and in Hindi version, has been appreciated by the users of every corner. It is for the vertical demand of the users, NATMO is still publishing the editions of the Atlas till today and regular updation and revision of the same is going on.

**(f) Publication of Atlases**

Keeping in view the success, popularity and demand of the 'National Atlas of India', Govt. of India has assigned NATMO the task of preparing different atlases on various themes for various departments and purposes, they have also become the important publications of NATMO. Some of those Publications are : Tourist Atlas of India, Atlas of Forest

Resources, Atlas of Agricultural Resources, Atlas of the City of Calcutta and its Environments, Water Resources Development Atlas, Land Resources Atlas, Indian Ocean Atlas, Socio-Economic Atlas, Science & Technology Atlas of India, Atlas on Population Changes in India, Irrigation Atlas of India, Hydrogeological Atlases of different states for the Central Ground Water Board, Integrated Water Resources Development Atlas for the National Commission of Integrated Water Resources Development and Plan, Resource Profile for Bankura and Kolar Districts (jointly with the Centre for Studies in Resource Engineering, IIT, Mumbai) for the NRDMS Division, Department of Science & Technology, Environmental Atlas of India and State-level maps on Environmentally Sensitive Zones and Siting of Industries for the Central Pollution Control Board, Tribal Map of India (jointly with Anthropological Survey of India), Block Maps for the whole State of West Bengal for the Panchayat and Rural Development Department, Govt. of West Bengal, Forest Atlas of India for the Department of Environment & Forest; National Cultural Heritage Atlas of India, Historical Atlas of India, District level communication and Infrastructure maps of Uttaranchal State, A to Z of Kolkata City Map, Natural Resources Atlas of Sikkim (as part of North-East Programme), Desertification Status Maps of Balia District (1:50,000 scale), Disaster Management Maps of Maldah, East & West Medinipur Districts of West Bengal for the Relief Department, Govt. of West Bengal, National Atlas of India, Satellite Atlas of India, School Atlas for the Visually Impaired (in Eng. & Hindi) ( in two volumes) - A TIFAC sponsored Programme of DST, Electronic Atlas of India (NRDMS Programme of DST) etc.

There is ample scope for this organisation to serve nation through some unique projects like School Atlas in different Indian languages, Archaeological atlas, Anthropological atlas, Indian Heritage atlas, Micro level maps as an extension of district planning maps, Landform maps etc. All the maps with rich write up can be prepared utilising geographers.

**Vision :**

As there is a full-fledged Digital Mapping System along with necessary peripherals and application software in its own, NATMO is in the process of digitization of all the atlases and maps so that it can be reached electronically to the users in the near future. NATMO has also initiated to prepare Water Quality Atlas of West Bengal (to earmark the arsenic-affected region) and Geo-Touristic Atlas of India (to provide a handy guide to the tourists) during this year.

**TRAINING AND DEVELOPMENT FOR S&T ADVANCEMENT OF THE COUNTRY**

NATMO also provides training on Thematic Cartography, Digital Cartography, Photogrammetry, GPS, Remote Sensing and GIS, Aerial Photography, Colour Cartography to the officers and staff of various govt. and private departments, university and college teachers, scholars and students of the country. Training courses of NATMO are held in high esteem by scientific departments and organizations all over the country as well as abroad. Last year, 450 persons were trained in NATMO.

NATMO Documentation Centre, Library & Archive, including its remote sensing archive provide service not only to officers and staff members of the organization itself, but a good number of technocrats, professors, post-graduate students, under graduate students

of geography use the library for books/ CD, topographical sheets, rare maps and remote sensing imagery.

**Vision :**

NATMO is also in the process of commencing full-fledged degree and diploma courses on thematic cartography, digital cartography, photogrammetry. Collaboration from various universities in this regard has been requested through Department of Science & Technology, Govt. of India. We are hoping that the courses will be commenced very soon.

**SCIENTIFIC RESEARCH**

NATMO employs a large number of highly qualified professional geographers, qualified statisticians, geologists and cartographers who are engaged in research for the technological advancement in the field of cartography in the geo-spatial arena. A good number of monographs, papers has been published in this regard which were highly held by the scholars and different departments of the country.

**INTERNATIONAL SCIENCE AND TECHNOLOGY COOPERATION**

NATMO represents in various international seminars/conferences to promote the use of geospatial information and technology in cartography and has also earned honour and fame in that field. Geo-informatics and Space Technology Development Agency (GISTDA), Government of Thailand has sought NATMO's cooperation in developing technologies for creation of data-base, preparation of large-scale maps, technological support for using THEOS data for mapping and also in providing training to GISTDA staff on mapping related issues. A MOU has been signed between DST and Govt. of Thailand in this regard As per

the MOU signed between Geoinformatics and Space Technology Development Agency, Govt. of Thailand and National Atlas and Thematic Mapping Organisation, Govt. of India, for cooperation in the field of Mapping and Geospatial Technology Applications, project on publication of an Archaeological Atlas, jointly by NATMO and GISTDA with thematic plates using high-resolution satellite data and geospatial technologies, to highlight the spread of Buddhism from India to South East Asia. The project will include India and participating ASEAN countries is going on.

#### **INFRASTRUCTURE DEVELOPMENT**

During the year, NATMO has almost completed the construction of Rashtriya Atlas Bhavan to get a wholly dedicated place for its

research activities which will house a complete Digital Map Laboratory and Printing & Camera Unit.

#### **Contact :**

**Prof. (Dr.) V.C. Jha**, Director, National Atlas & Thematic Mapping Organisation (NATMO), Ministry/ Deptt. of Science & Technology, Govt. of India, C.G.O. Complex (7th fl), DF Block, Salt Lake, Kolkata-700 064, Phone : 033-23345006/ 6331/ 6459 Fax : 033-23346460  
Website: [www.natmo.gov.in](http://www.natmo.gov.in)

#### **Campus :**

**Rashtriya Atlas Bhavan National Atlas & Thematic Mapping Organisation (NATMO)**, Ministry/ Deptt. of Science & Technology, Govt. of India, Block GN-35, Sector-V, Salt Lake, Kolkata-700 091, Phone : 033-23578401/ 4949

**CONFERENCES / MEETINGS / SYMPOSIA / SEMINARS**

**23<sup>rd</sup> National Laser Symposium, Sri Venkateswara University, Tirupati, December 3 - 6, 2014.**

**Topics :**

- Physics and Technology of Lasers
- Lasers in Nuclear Science and Technology
- Laser Materials, Devices and Components
- Non-linear, Quantum and Atom Optics
- Ultrafast Lasers and Applications
- Lasers in Material Science
- Laser in Plasma Interaction
- Lasers in Industry and Defense
- Laser Spectroscopy and Applications
- Lasers in Chemistry, Biology & Medicine
- Laser Based Instrumentation
- Electronics and Instrumentation for Lasers

**Contact : Shri A. S. Joshi**, Convener, NLS-23, Laser Plasma Division, RRCAT, Indore-452013, Phone : 0731-2488461, Email : [convenernls23 @ gmail.com](mailto:convenernls23@gmail.com)

**Fifth International Conference on Plants & Environmental Pollution (ICPEP-5), 3-6 December 2014, Lucknow, India.**

**Topics :**

1. Bio-Indication & Bioremediation
2. Environmental Microbiology and Biotechnology
3. Environmental Impact Assessment & Eco-Auditing
4. Environment & Biodiversity
5. Plant Responses to Environmental Pollution
6. Climate Change & Human Health
7. Climate Change and Global Food Security



8. Impacts of Air Pollution & Climate Change on Forest Ecosystem
9. Role of Botanical Gardens in Climate Change Research
10. Environmental Education, Environmental Laws, Outreach & Information
11. Contemporary Environmental Issues :
  - (a) Paleo-environment
  - (b) Environmental impact on cultural heritage
  - (c) Environmental systems and disaster management
  - (d) Hospital wastes management
  - (e) Indoor pollutants
  - (f) Bio-pollutants
  - (g) Bio-energy/Biofuel
  - (h) Sustainable agriculture & food Security
  - (i) Alien Plant Invasion
  - (j) Bio-prospecting
  - (k) Noise pollution
  - (l) Urban pollution & green belt designing
  - (m) New & Renewable Energy

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**S & T ACROSS THE WORLD****MYSTERIOUS BURSTS OF RADIO WAVES IDENTIFIED FAR OUTSIDE GALAXY**

Mysterious split-second pulses of radio waves are coming from deep in outer space, and nobody knows what causes them, according to astronomers.

Researchers led by Laura Spitler from the Max Planck Institute for Radio Astronomy in Bonn, Germany say they have found the first so-called "fast radio burst" in the sky's northern hemisphere, using the Arecibo radio telescope in Puerto Rico.

The mystery is reminiscent of that of gamma-ray bursts, discovered in the 1960s and now thought to come from giant stars collapsing to form black holes. The new phenomenon, in the form of radio rather than gamma-rays—a different form of light—remains an enigma.

The flashes last only a few thousandths of a second. Scientists using the Parkes Observatory in Australia had recorded such events before, but the lack of similar findings by other telescopes led to speculation that the Australian instrument might have been picking up signals from sources nearby Earth.

The finding at Arecibo is the first detection using a different telescope: the burst came from the direction of the constellation Auriga in the Northern sky, according to the scientists, who detail their findings July 10 in the online issue of *The Astrophysical Journal*.

"There are only seven bursts every minute somewhere in the sky on average, so you have to be pretty lucky to have your telescope pointed in the right place at the right time," said Spitler, the paper's lead author. "The characteristics of the burst seen by the Arecibo telescope, as well as how often we expect to catch one, are consistent with the characteristics of the previously observed bursts from Parkes."

"The radio waves show every sign of having come from far outside our galaxy – a really exciting prospect," added Victoria Kaspi of the McGill University in Montreal and principal

investigator for the pulsar-survey project that detected the burst.

Possible causes, scientists said, include a range of exotic astrophysical objects, such as evaporating black holes, mergers of neutron stars, or flares from magnetars—a type of neutron star with extremely powerful magnetic fields.

The pulse was detected on Nov. 2, 2012, at Arecibo, with the world's largest and most sensitive single-dish radio telescope.

The result confirms previous estimates that the bursts occur roughly 10,000 times a day over the whole sky, said the astronomers, who inferred the huge number by calculating how much sky was observed, and for how long, to make the few detections so far reported.

The bursts appear to be coming from beyond the Milky Way galaxy based on measurements of an effect known as plasma dispersion. Pulses that travel through the cosmos are distinguished from man-made interference by the effect of electrons in space, which cause longer radio waves to travel more slowly.

*(Courtesy of the Max Planck Institute for Radio Astronomy and World Science staff)*

**NEWFOUND GENE COULD PLAY ROLE IN AGING FROM BIRTH**

It's something of an eternal question: Can we slow or even reverse aging? Although genetic manipulations can alter some cellular processes, not so much is known about the mechanisms of the aging process in living things.

Now scientists have found in animal models that one gene plays a surprising role in aging that can be detected early on in development. They say the discovery could point toward the possibility of one day using therapeutics, even some commonly used ones, to manipulate the aging process itself.

This "developmental gene, known as Spns1, may mediate the aging process," said Shuji Kishi, a professor at the from the Florida campus of The Scripps Research Institute who led the study, published by the journal *PLoS Genetics*. "Even a partial loss of Spns1 function can speed aging."

Using various genetic approaches to disturb Spns1 during the embryonic and/or larval

stages of zebrafish—which have emerged as useful for studying diseases associated with development and aging—the scientists said they produced some models with a shortened life span, others that lived long lives.

While most studies of “senescence”—decreases in a cell’s power of division and growth—have focused on later stages of life, the new study explores early stages. “Mutations to Spns1 both disturbs developmental senescence and badly affects the long-term bio-chronological aging process,” Kishi said.

The study found that Spns1, along with a pair of “tumor suppressor genes,” called beclin 1 and p53, can influence senescence through two different mechanisms: the Spns1 defect was enhanced by Beclin 1 but suppressed by ‘basal’ p53. Spns1 also was found to hinder autophagy, a process whereby cells remove unwanted or destructive proteins and balance energy needs during various life stages.

Building on their insights from the study, Kishi and his colleagues noted in the future therapeutics might be able influence aging through Spns1. He said a commonly used antacid, Prilosec, has been shown to temporarily suppress autophagic abnormality and senescence seen in the Spns1 deficiency.

*(Courtesy of the Scripps Research Institute and World Science staff)*

## NEW PARTICLE IS BOTH MATTER AND ANTIMATTER

Physicists used a scanning-tunneling microscope to image a thin chain of iron atoms atop a superconductor made of lead (yellow bar). The colors here represent the quantum probability that any given spot contains a so-called Majorana particle, which is both matter and antimatter. The zoomed-in portion shows that the propability of finding a Majorana particle increases greatly at the ends of the wire, as theory predicts it should.

Since the 1930s scientists have been searching for particles that are simultaneously matter and antimatter. Now physicists have found strong evidence for one such entity inside a superconducting material. The discovery could represent the first so-called Majorana particle, and may help researchers encode information for quantum computers.

Physicists think that every particle of matter has an antimatter counterpart with equal mass but opposite charge. When matter meets its antimatter equivalent, the two annihilate one another. But some particles might be their own antimatter partners, according to a 1937 prediction by Italian physicist Ettore Majorana. For the first time researchers say they have imaged one of these Majorana particles, and report their findings in the *Science*.

The new Majorana particle showed up inside a superconductor, a material in which the free movement of electrons allows electricity to flow without resistance. The research team, led by Ali Yazdani of Princeton University, placed a long chain of iron atoms, which are magnetic, on top of a superconductor made of lead. Normally, magnetism disrupts superconductors, which depend on a lack of magnetic fields for their electrons to flow unimpeded. But in this case the magnetic chain turned into a special type of superconductor in which electrons next to one another in the chain coordinated their spins to simultaneously satisfy the requirements of magnetism and superconductivity. Each of these pairs can be thought of as an electron and an antielectron, with a negative and a positive charge, respectively. That arrangement, however, leaves one electron at each end of the chain without a neighbor to pair with, causing them to take on the properties of both electrons and antielectrons—in other words, Majorana particles.

As opposed to particles found in a vacuum, unattached to other matter, these Majoranas are what’s called “emergent particles.” They emerge from the collective properties of the surrounding matter and could not exist outside the superconductor.

The new study shows a convincing signature of Majorana particles, says Leo Kouwenhoven of the Delft University of Technology in the Netherlands who was not involved in the research but previously found signs of Majorana particles in a different superconductor arrangement. “But to really speak of full proof, unambiguous evidence, I think you have to do a DNA test.” Such a test, he says, must show the particles do not obey

the normal laws of the two known classes of particles in nature—fermions (protons, electrons and most other particles we are familiar with) and bosons (photons and other force-carrying particles, including the Higgs boson). “The great thing about Majoranas is that they are potentially a new class of particle,” Kouwenhoven adds. “If you find a new class of particles, that really would add a new chapter to physics.”

Physicist Jason Alicea of California Institute of Technology, who also did not participate in the research, said the study offers “compelling evidence” for Majorana particles but that “we should keep in mind possible alternative explanations—even if there are no immediately obvious candidates.” He praised the experimental setup for its apparent ability to easily produce the elusive Majoranas. “One of the great virtues of their platform relative to earlier works is that it allowed the researchers to apply a new type of microscope to probe the detailed anatomy of the physics.”

The discovery could have implications for searches for free Majorana particles outside of superconducting materials. Many physicists suspect neutrinos—very lightweight particles with the strange ability to alter their identities, or flavors—are Majorana particles, and experiments are ongoing to investigate whether this is the case. Now that we know Majorana particles can exist inside superconductors, it might not be surprising to find them in nature, Yazdani says. “Once you find the concept to be correct, it's very likely that it shows up in another layer of physics. That's what's exciting.”

The finding could also be useful for constructing quantum computers that harness the laws of quantum mechanics to make calculations many times faster than conventional computers. One of the main issues in building a quantum computer is the susceptibility of quantum properties such as entanglement (a connection between two particles such that an action on one affects the other) to collapse due to outside interference. A particle chain with Majoranas capping each end would be somewhat immune to this danger, because damage would have to be done to both ends simultaneously to destroy any information encoded there. “You could build a quantum bit

based on these Majoranas,” Yazdani says. “The idea is that such a bit would be much more robust to the environment than the types of bits people have tried to make so far.

(Courtesy Princeton University)

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## WHERE DOES EBOLA HIDE ?

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Fruit bats are the most likely carriers of Ebola but it is human-to-human transmission that matters most now. The people of Guinea have been locked in a life-and-death struggle with Ebola virus since last December. Nearly 60 percent of Guineans infected with the virus since then have died. To cope with the unprecedented disease, the government went so far as to ban soup made from bats.

Why bats? Because three kinds of bats from the region are believed to harbor the deadly filovirus. That's based on a survey of small animals in Gabon and the Democratic Republic of the Congo, where the Ebola virus seems to be endemic. The DRC even hosts the Ebola River that gave the virus its name. (It is a tributary of the Congo River that gives the country its name.)

Although Ebola does not kill the bats as far as scientists know, it does kill more than humans—the virus has devastated chimpanzee and gorilla populations as well. So intrepid researchers from the International Center for Medical Research of Franceville in Gabon set out to trap small animals that might harbor the disease from forest regions that had recently been devastated, starting in 2001.

All told, the researchers gathered 679 bats, 222 birds and 129 mice and other small mammals over several years to test for evidence of the Ebola virus. A few individuals from three different kinds of fruit bats tested positive for an immune response to the disease or had pieces of its RNA in their cells, although no one has yet found the actual virus in these bats. The three fruit bat species are the hammer-headed bat (*Hypsignathus monstrosus*), Franquet's epauletted bat (*Epomops franqueti*) and the little collared bat (*Myonycteris torquata*).

All three bats are widespread in Africa, including the regions of west Africa that are now afflicted with the disease for the first time, although it is the far western edge of

their range. All eat fruit and it is unclear how or even if the disease jumped from bats to humans or if there was an intermediate host, such as apes. Researchers and health officials still do not even know whether bat-to-bat transmission, bat-to-human transmission or bat-to-other animal-to-human transmission is responsible for the beginning of the current outbreak. And it remains far from clear that bats are the hosts of the deadly zoonotic disease since two similar surveys of thousands of animals, including bats, at sites where human outbreaks occurred in the past failed to turn up any sign of Ebola virus.

What is clear is that human-to-human transmission is the main cause for the continuing outbreak this time. A genetic analysis of the virus showed that since at least May there has been no evidence of any crossover from bats or any other animal to humans. In fact, the disease bears much the same genetics from Liberia to Guinea, suggesting a single jump from some animal to a human that happened in eastern Guinea. People afflicted with the disease suffer from high fever, diarrhea, vomiting, pain and sometimes bleeding. Contact with such bodily fluids is the way the disease spreads from person to person, with symptoms of infection taking two to 21 days to manifest themselves. In fact, the genetics suggest that the outbreak in Sierra Leone stems from a single funeral held in Guinea in late April, according to a paper published in *Science* Sept 12, 2014. Five of the co-authors of that paper died from Ebola in the course of researching the epidemic's roots.

Nearly 8,400 people have now suffered from the disease, and almost half (4,033) have died, according to the World Health Organization. Those are just the reported cases, so the WHO figures likely underestimate the real impact of the disease. The epidemic has been exacerbated by distrust of government; a persistent rumor that Ebola does not exist still circulates in the region as does one that it was purposefully introduced by international medical workers.

To counteract these rumors imams in Guinea were tasked with spreading the message of good hygiene during some 7,000 sermons over the recent Tabaski Festival. And the government carried out a coordinated campaign of text messages bearing good

hygiene information. In this case, hygiene primarily involves staying clear of bodily fluids from those afflicted with the Ebola virus—and that involves ending traditional burial practices that include a thorough cleansing of the corpse, which remains contagious for several days after death. Other rules are relatively simple: wash hands often; do not shake hands; and do not eat meat from animals found dead in the forest.

At the same time, however, some of the steps taken by international groups and national governments, such as quarantines, may have exacerbated the outbreak, according to medical anthropologist Barry Hewlett of Washington State University. Hewlett published the definitive account of the local response to such outbreaks in central Africa in the late 1990s and early 2000s: "Ebola, Culture and Politics: The Anthropology of an Emerging Disease." Most of those earlier outbreaks stemmed from people finding, butchering and eating apes found dead in the forest, although some seem to have started with soldiers moving across regions carrying the illness. The key to stopping an outbreak is trust, a trust developed between the sick, the infected, the local populace and authorities, so that hygiene rules can promulgate. Such trust is easily destroyed by a forcefully imposed quarantine that traps the healthy with the sick, Hewlett notes.

In the 41st week of the outbreak in Guinea the spread of the disease shows no signs of slowing, with the majority of cases to date reported in just the last three weeks. Health workers are recording roughly 100 new cases per week, including in the capital of Conakry. And it still remains unclear where the virus came from when it made the leap into humans last December in the forests of eastern Guinea. "Humans have been responding to deadly outbreaks for thousands of years," Hewlett notes. "We have minds adapted to deal with them, we have accumulated cultural knowledge of options, we have culture to adapt relatively quickly." But as it stands, WHO predicts that the outbreak will not end before next year—and that is the best-case scenario. And the host of the Ebola virus is still hiding somewhere in the forests.

(Courtesy *Scientific American*,  
October 14, 2014)