EVERYMAN'S SCIENCE

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COVER PHOTOGRAPHS ***(From the Top)***

Past General Presidents of ISCA

1. Prof. S. K. Mitra	**(1955)**
2. Dr. M. S. Krishnan	**(1956)**
3. Dr. B. C. Roy	**(1957)**
4. Prof. M. S. Thacker	**(1958)**
5. Dr. A. L. Mudaliar	**(1959)**
6. Prof. P. Parija	**(1960)**

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EDITORIAL

PANIC IN PUBLIC HEALTH

Several severe unexpected onslaughts on public health have caused devastating disasters in recent years, that once again have revealed the weak infrastructure of our public health system and the sheer helplessness to tackle such situations in a meaningful way, resulting in enormous economic loss besides unbearable agony, unusual panic, and overt restlessness grabbing the whole country. Needless to say, all sorts of media took the leading role, and even dictated what to do and what not to do. So-called courses of action to be taken up were also suggested. The part played by the World Health Organisation (WHO) was also not well understood.

Examples can be cited one after another.

Plague, a dreaded disease of the past, is not existing now in India. But in 1994 all on a sudden in September from Surat City, Gujarat state a rumour of plague was raised. Some suspected cases of pneumonic plague were reported without a valid basis. It was alleged that due to that disease 56 deaths took place. Within a very short span of time the panic of the disease spread like a fire all over the country and 6700 people were admitted in hospitals of different states (Gujarat, Maharashtra, Delhi, West Bengal, Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, Orissa etc.) and 337 of them were supposed to be positive for plague bacilli. There was an organised propaganda. But actually the nature of the disease was very much obscure. The ratfall was not there. The classical chronological features of plague epidemiology leading to pneumonic plague were not substantiated. Some people purposefully advanced the theory of spread of pneumonic plague, though clearcut features were absent. From West Bengal, specially from the Calcutta School of Tropical Medicine a strong protest was raised. The baloon of plague was soon punctured. Some people were of the opinion that such type of panic was raised deliberately by a group of interested people to enhance the sale of doxycyline capsules which were lying in the stores. Our country suffered a huge economic loss. The so-called plague epidemic vanished thereafter for ever.

Do we remember SARS (Severe Acute Respiratory Syndrome) ? The panic of SARS crippled the whole of India for 2-3 months starting from April 2003. It was at that time termed as the disease of the new millennium. This viral disease probably originated in South China in November, 2002. It was estimated by the WHO that throughout the world the disease would create a havoc. But it did not happen. 25 countries including India were affected with about 600 deaths.

SARS also created havoc in the public health system in India. As usual, media became hyperactive and were almost determined to prove that SARS has entered India and severe consequences would occur. At least 20 people were suspected, but SARS virus was not detected except in one case, who was also ultimately cured. The economy and industry of our country did suffer due to SARS panic. It was estimated that the loss in travel industry alone was 1500 crores of rupees. According to some observers, vested interest here also played a great role to spread the panic not only in India, but also throughout the world in the name of public health for the sale of some particular antiviral medicine. SARS again suddenly disappeared and so SARS ultimately became a farce.

Then came bird flu, the causative organism of which is H_5N_1 virus. It is essentially a disease of the birds, that may affect human beings through droplets during any sort of contact with birds or

through the saliva or stools of birds or by taking their raw or half cooked meat. The field was already prepared. The panic of birdflu also spread like a fire.

Birdflu was first detected in HongKong in 1996. It took seven years to enter India. The first affected state was Maharashtra (2006). Throughout the world extensive propaganda was conducted. In a report of the UNO, it was published that birdflu would kill 150 million people in the world. But uptil now, the fact is that human infection has rarely been found and of about 170 people infected, 93 died.

Here, in India in many States including West Bengal, along with birdflu in some affected areas where some unusual deaths among the poultry were detected, millions of birds were killed to get rid of the so-called disease burden among them. Some particular antiviral drug was stocked by the governments of various countries of the world according to (practically mandatory) WHO guidelines, either for prophylactic use by those people who were involved in culling or for future use in fear of anticipated epidemic or pandemic. Needless to say, uptil now not a single person in India has been attacked with birdflu.

The last but not the least in this series is swineflu which is more correctly and scientifically known as pandemic A (H_1N_1) influenza 2009. This is a new strain of influenza virus. Animal reservoirs provide new strains by recombination between the influenza virus of man, animal and birds. This new virus, though originated in swines, is transmitted directly from human to human usually through droplets during sneezing, coughing, talking etc. This is direct contact within one metre of an infected person. Indirect contact by touching a contaminated surface may also occur. It is not transmitted by pigs. The incubation period is one day before and 7 days after the onset of symptoms. The symptoms include high fever, cough, sore throat, running nose, loose stools and difficulty in breathing. The spread of this now H_1N_1 flu was miraculously fast. Starting from Mexico in April 2009, it affected 168 countries including India and was declared as pandemic by the WHO on 11 June, 2009. As on 13 August 2009, the infection was detected in 1,82,166 persons, with 1,799 (0.98%) deaths. In India, upto september 2009, 333 deaths were reported. But it should be mentioned that most of them were suffering from other complicated diseases also.

As some unfortunate deaths did take place, this time there was more pandemonium than before along with the highest degree of panic, though according to some WHO experts the persent H_1N_1 virus did produce mild disease in majority of affected persons. The death rate is extremely low. Almost all the media played the same role in a tune, which rather helped to spread the horror instead of assessing the bare scientific facts and providing reassurance to the masses who were naturally bewildered.

Indian public health system is very weak and fragile and is overburdened with many serious public health problems. To mention a few, in India more than 1500 people die of gastro-intestinal infections every day, TB kills more than 1000 persons a day, about 20,000 people die of rabies per year, about 15,000–20,000 people die of snake bites. Preventable insect borne diseases such as Malaria, Dengue, JE, Chikungunya, Kalaazar, etc are perennial problems, which after so many years of independence we were not able to get rid of.

True, if a new devastating disease invades, it will further damage our health system. But for the diseases mentioned above, the question of overestimation, overcautiousness, overactivities, overapprehension and overenthusiasm cannot be ruled out. Limited resources must be utilized in a proper way. We shall have to fix our priorities. Again, it is a pity that we have no national data

on morbidity and mortality due to common flu, that also kills many people throughout the world, for which there is vaccine.

And a big question has been raised. Again and again it was alleged that to sell a particular antiviral drug throughout the world, deliberately this panic has been created by a section of people with a vested interest. It has been said that a company has made a profit of 10,000 crores of rupees from India alone raising swineflu panic. During swineflu panic, more than 20 lacs of masks were sold.

There must be some limit. We should remain alert and at the same time judicious. Some effective steps should be taken to prevent the spread of rumour and panic. A public health disaster management committee may be formed at the national level. An integrated approach is essential keeping in view indigenous requirements and international pressure, specially when it appears that these diseases started with a big bang but ended with a whimper.

Amiya Kumar Hati

"Religion is to do right. It is to love, it is to serve, it is to think, it is to be humble."

—R. W. Emerson

PRESIDENTIAL ADDRESS

ON SCIENCE FOR HUMAN WELFARE AND DEVELOPMENT OF COUNTRY

DR BIDHAN CHANDRA ROY* M.D., M.R.C.P., F.R.C.S. (ENG.), D.SC.

Mr. Prime Minister, Delegates and Friends :

I extend my cordial greetings to the distinguished scientists who have gathered here today, as they do every year, to exchange notes regarding the latest discoveries in the various fields of their search after truth. The Indian Science Congress Association meets annually with the main object of discussing how best the latest researches and investigations in Science could be utilized for the promotion of human welfare in general and for the development of the country.

We are meeting at a time when we have successfully completed the First Five Year Plan in India and have just started on the Second Plan. For the implementation of a plan of this magnitude we would need the services of many more scientists, many more engineers, many more physicists, and many more technologists than are available in the country at present for its rapid development in various directions. The more we come to appreciate the latest developemts in Science and their application to human welfare, the more we begin to realise that while material resources are no doubt a fundamental requirement for the successful development of the country, we depend no less upon human resources. Moreover, it is not merely the technical knowledge, which one may possess that will help in his task, it is equally essential that there must be developed ability to apply this knowledge to the organization and development of industries and to the production of means of human welfare. There is, moreover, the need for adaptation. We might get technical knowledge from other more advanced countries, but the scientists of India should be able to adapt this technical knowledge to the needs of the country, so that it may be effectively operative under different climatic and environmental conditions and for utilisation of indigenous raw materials. It is, therefore, not enough to borrow from other countries the results of their researches ; we should be able to undertake original researches our selves and adapt the results of such researches to the conditions obtained in our own country. Such researches would be a continuous, and no doubt, an arduous process too. Without it no progress can be achieved in this competitive world.

In this country we have been doing research in scientific subjects for the past 40 years or so, but we have not achieved much in engineering and technological research, namely, research in design, research in development of machinery or its manufacture, erection and maintenance. For an underdeveloped country like India, it is not essential that we should ourselves be able to manufacture machinery and build up factories, but we should also know how to do it with the materials that we possess. Engineering research does not merely mean the application of Physics to engineering problems, but it also includes such new lines of advancement in engineering as biological and chemical

* General President, Forty-fourth Indian Science Congress held at Calcutta during January 1957.

engineering and public health engineering, which have definite social values, as they deal with problems which affect the common man. Development in these lines can be achieved only through patient and persistent research. Other countries have done so and have gone ahead, and we in this country should not delay in utilizing whatever resources we possess for the development of engineering in these directions. Steps taken towards this end may even mean our taking some amount of financial risk, but this is worth doing. Human mind ordinarily follows a particular groove and does not easily adapt itself to new ideas. Scientists would indeed be doing a great service to society if they would demonstrate to the common man the value of quickly adapting and utilising the results of new researches.

A glance at the Second Five Year Plan will reveal that quite a large number of development schemes have been included which would involve such huge cost that we may find it difficult to implement them unless our engineers and technicians are able to find effective and yet cheaper methods of executing these projects. Experience has shown that through scientific methods raw materials may be produced more cheaply and abundantly. Therefore, we have to secure the help of scientists to make available to us cheaper raw materials. In this country, we possess a vast potential of manpower, which we may be able to utilise and thus lower the total cost considerably. But that would mean that the designs of construction and the methods involed should be such that without much specialised skill the common man may be able to easily understand these, and take his full share in executing them. Take, for instance, the building of houses for the large number of our people who live in the city slums or in the rural areas. If the usual plan of the professional architect is followed, it would entail skilled processes and heavy expenditure so much so that the projects may become prohibitive. On the other hand, if the plans and designs for construction are simplified and locally available materials are utilised, even ordinary individuals may be able to give their helping hand in building their own houses and the total cost may be made considerably cheaper.

Sometimes I am inclined to envy the votaries of Science, who like yourselves, devote their whole time, energy and intellect to discovering something new. It was not given to me to devote myself exclusively to the pursuit of Science and to unravel the mysteries of life. When I was a young student of Science, I had learnt that "Matter is indestructible". Since then as a medical practitioner, it has been my lot to face life under varied conditions, and I have also been a witness to hundreds of deaths. I have often wondered what gives life its versatility—what it is that makes one person so different from another. On the other hand, I have also wondered what the lifeless body signified. Matter, says the scientist, is indestructible, and yet, I ask what happens to the dead body, which is composed of matter, after it is buried under the earth or consigned to the flames ? What becomes of the matter composing the body ? Obviously it changes its character. The elements of which a body is composed get diffused to the four corners of the earth and get mixed up with similar and other elements. The process indicates a transmutation of the basic elements of the human body. The conclusion is inevitable that the fundamental elements composing the human body change their characteristics or form but they are not destroyed. It is yet a mystery as to what extent an individual when dying releases forces which consciously or unconsciously go on affecting generations of human beings that follow him. From science I was drifting into the field of mysticism or perhaps spirituality.

History tells us that in the last 2,500 years, 902 wars have been fought, 1,615 internal dissensions have taken place, which have rent nations asunder. The most bellicose period of the world history has been the first half of the 20th century. We are now

in the midst of a new Era, call it the Atomic Age. Science has found a new and a vast source of energy which has put into man's hands great power, for good or for evil. Whether the hydrogen bomb will prove to be the doom of mankind, or a stabilising force for permanent peace cannot yet be predicted. On the other hand, it is also true that materials developed from Nuclear Reactors can be wholly beneficient. They create a host of new substances, mainly radioactive, which are proving to be of the greatest value in research, medicine, agriculture and industry and one day, perhaps very soon, we will make available new sources of energy by using fissionable materials as fuel. This fuel will not only be highly concentrated but will be easily transportable to countries where coal may be scarce or oil may not be available or even water power may not have been developed.

Will peace prevail as civilisation advances ? At least history lends no support to this belief. Man has been getting more civilised and yet discovering more and more destructive weapons of killing. Violence is not known to have given a quietus to violence. No war has been able to end all wars. The last two world wars revealed another distressing feature : during hostilities the peaceful citizen was as much a victim of hostile action as a combatant of a military establishment. Wars have today assumed a totalitarian character. The development of guided missiles may mean destruction of whole cities, of districts, and countries from sources thousands of miles away—and, may destroy everything contained therein, the unarmed citizens' houses and farms, schools, hospitals, and places of worship, the sources of food and water. Were the scientist and the technologist, who created the machinery of war, the witting or the unwitting instruments of military leaders, or were the scientists merely chips drifting along in the turbulent stream over which they had no control ? We know that the one pursuit of the physicist and chemist is the discovery of the nature of matter and energy ; the one purpose of the technologist is to apply that energy in changing the social environment ; and, the one purpose of the capitalist is to make profits through that energy. Thus both industry and war have provided the momentum which ever increases the output of energy. But can the scientists be held responsible for this perversion of Physics and Chemistry ? It is not he who declares war ; nor it is he who leads the armies. Yet he has been as direct an aid to military States as if he had been commanded to make discoveries of military importance. This is because his problems are given to him by a society in arms of Militant State.

Scientists and engineers of the 15th, 16th and 17th centuries were aware of their relation to the Military State. Leibnitz, Denis Papin, Otto Von Guericke and others dabbled in military mechanics. Leonardo offered his services to the Duke of Milan, primarily as a military engineer ; Galileo was a professor of Military Science Voyages to the undiscovered India, America and Africa created a demand to determine the position of the ship in an unchartered sea. The classic studies of magnetism made by William Gilbert, in the 17th century, followed the observation of mariners on the vagaries of the compass-needle. Roger Bacon and Berthhold Schwarz, mere monks, are credited with the discovery of a simple mixture, which was gunpowder. All explosives from gunpowder to Trinitrotoluene were developed by civilians.

And, yet it is Science which has been the cementing agency between peoples of different races, religions, traditions and customs. When a whole population uses a common railway system, telegraph and telephone links, or listens to music and speeches radiating from a common broadcasting station, or thrills at the same cinematographic film projected at a thousand theatres simultaneously, or rides to and from work in common carriers like omnibuses and tramcars, or wears standardised garments and shoes, there results a sense of unity. Then Science becomes an agency that draws

millions of people into one common fabric of human society or social order.

We are here presented with a paradox. Science and technology are essentially international in spirit. By training, these principles can be inculcated anywhere. But the industrial fruits of Science and technology are governed by economic or military factors. While scientific progress sometimes takes place because of the constant internal urge of the physicist, chemist and technologist to seek newer objects of research, the greatest stimulation to such progress has been dictated by the economic needs of a country or the exigencies of war. This mobilisation of Science and technology has made it impossible for the small and technologically backward nations to wage mechanized wars without external assistance. The dread of finding itself cut off from food supplies and industrial materials develops an instinct of self-preservation in a country. It strives to have a type of nationalism which wants to secure raw materials for the country's safety and production. Thus one country's desire spells another country's danger. A country cannot but retain what it has gained and struggle for more. The type of nationalism which develops in the country is economic or political in spirit and the citizen becomes the member of an industrial and military State.

During the last twenty years, scientists have slowly awakended to this abuse of their talents and discoveries. They have seen as much misery flow out of the misapplication of their work as out of war. They now crave for the opportunity to improve the quality of the human stock through the wider support and application of Eugenics : They dream of producing synthetic substitutes of meat, milk and eggs ; they hold out the promise of a world in which poverty and misery will be unknown. They maintain that in the past, Science had been compelled to pursue an irrational course, which had little relation to the realities of life.

Today, through Science, wherever physical expansion of an area is not possible, new means of crop production and new industrial methods are discovered, which go to create the wealth necessary to raise the standard of living and banish the spectra of unemployment. These are brought about through painstaking researches. The stuff of which the Universe is composed is being torn apart, molecule by molecule, atom by atom, and out of the atomic fragments new kinds of matter are being created and new energy is being released.

To nine persons out of ten, the chemist is still something of a magician, a mysterious figure, impelled to mix together strange and sometimes dangerous substances, only to discover that he has at his command, an explosive that will blast mountains or a plastic that can be a substitute for any known material of common use. It is so with the technological chemist, the metallurgical chemist, the nutritional chemist who manufactures synthetic foods and artificial dress materials like rayons and nylons and plastics. Today we are in the throes of a Chemical Revolution.

Synthetic Chemistry cannot ignore the progress made in "chemotherapy", to which I wish to make a reference in detail. Paul Ehrlich, who coined this term, limited it to the chemical treatment of bacterial diseases ; but today pharmachologists are inclined to describe Chemotherapy as that branch of science which deals with chemical effects of drugs on living organisms. They include among the chemotherapeutic agents hormones, vitamins, pain-killers, sleep producers and a host of such sub-stances. Even quinine from Peruvian bark, extracts from toads and cobra venom, which affect the nerves and stimulate the heart, belong to the same category. The story of scientific chemotherapy, a subject which is of great interest to me, starts with Ehrlich's classical study of syphilis. Ehrlich discovered that certain dyes, derived from Naphthalene, would only stain the germs inside the tissues which themselves remained unstained. This

gave Ehrlich the cue to the discovery of a germicide which would attack the microbes and yet leave the animal tissues unaffected. He knew that many tropical diseases like Kala-Azar, sleeping sickness, dysentery were caused by protozoa. Sleeping sickness, endemic in Africa, was caused by protozoa called trypanosome. After patient and laborious research, Ehrlich found a harmless chemical which would seek out a germ in the tissues. To this chemical was to be attached a killer which would destroy the bacteria. Arsenic was found to be such a killer. By repeated experiments he succeeded in combining arsenic with a selective organic compound. When Schaudin discovered that syphilis was caused by a protozoa called Spirochete, he also discovered that Spirochete and Trypanosome were similar in nature. With this knowledge in his possession Ehrlich found an organic compound, 914 Neoarsphenamine, which could be injected to cure syphilis which had till then been a menace to society.

The medical world was elctrified by Ehrlich's success. If syphilis could be treated by chemotherapy, why not a lot of other infectious diseases caused by "Cocci" and by "Bacilli" ? Streptococci, Staphylococci, Gonococci, Menigicocci and Pneumococci, which cause widespread infections and devastation among human beings could be treated in a similar manner. Chemists working in Farben Industry experimented with "Azo' dyes and found them useful for blood infections by Streptococci. They called this drug Prontosil.

While these new discoveries regarding chemotherapeutic drugs were being made, Dr. Dabos of the Rockefeller Institute for Medical Research extracted a powerful germicide from the soil which healed the wounds of Empyma, Carbuncle, boils and ulcers. He wondered how the soil which itself is full of deadly germs manages to produce plants in abundance, how the disease germs which kill a man are themselves killed when he is buried ? Evidently the soil is self-cleaning. This finding was interesting and Dabos found a chemical Tyrothricin in the soil which killed the germs. An accident, however, led to the discovery of a chemotherapeutic agent more powerful than Tyrothricin. The discoverer was Sir Alexander Flemming and what he discovered was Penicillin. Flemming was growing some Staphylococci in Petri dishes and he noticed that in some places the Cocci were not growing. Spots of green mould had appeared in these places. In September 1928, Flemming made cultures of the green mould, which he found to be a variety of Penicillium and he called the pure culture Penicillin—an ideal chemotherapeutic agent. Such moulds generally grow on cheese, on trees and on the soil, which we in our ignorance have regarded as useless, if not dangerous. Some more research work had to be done before Penicillin could be made available for therapeusis. In 1930, Dr. Florey discovered that in body secretions, i.e., tear, saliva and in egg white there was an enzyme (Lysozyme) which dissolved bacteria. (No wonder animals lick their wounds.) He studied Penicillin from various aspects and produced it in sufficient quantities in a purified form for clinical use. There are now 100,000 type of moulds which can yield antibiotics.

Thus with the arsenical compounds used in treating syphilis, with the Sulfa drugs, with Tyrothricin, and lastly with Penicillin and allied antibiotics we have an array of chemotherapeutic drugs available to save mankind from the ravages of microbes. Such researches only prove that the human body is a delicately balanced chemical apparatus. Destroy that balance and we fall sick. To cure a disease chemical balance must be restored. Poison must fight poison. One such poison in the human body is Insulin, which controls the utilisation of sugar in the body, another is Adrenalin which is a valuable drug in haemorrhagic conditions. The Vitamins and Hormone about which we hear so much also act as chemotherapeutic agents, and

they direct metabolism in the human body. We often wonder why we get old. It is because the body's chemistry has changed. Turn where we will within us and we discover chemicals at work. Therefore, the development of chemotherapy is part of the chemical revolution that is changing life and industry.

Ever since the days of Charles Darwin physiologists and anatomists have had their doubts as to how long primitive savage man will survive the nervous strain of machine world where he lives an artificial life in an artificial environment. At a recent Congress of the American College of Surgeons, Dr. Buerki, President of the American Hospital Association presented a picture of a modern man, a victim of high blood pressure, enlarged, heart, failing circulation, jangled nerves, result of doing several things at the same time. At Yale, the Nobel Prize winner Sir Joseph Barcroft showed how delicate is the balance between mind and body and how quickly the mind succumbs when the conditions under which the body naturally thrives are only slightly changed. In 1936, at the meeting of the British Association for Advancement of Science, Prof. Hawkins, the distinguished palaeontologist said that man was the "only irrational creature".

The glory and the curse of the man is his Brain. While it raises him above the beasts, it dooms him as a species, for the brain is getting overdeveloped and over-specialised. It endows him with a mind that conceives new machines to take the place of muscles, new instruments to supplement inadequate senses, new and complex ways of living in communities. The poor body cannot adapt itself rapidly enough to the social and technological changes conceived by the mind. Heart and muscle belong to the jungle, the modern mind of man has an environment of its own creation. The verdict appears to be that man must crack under this strain.

It is the simple organism that endures. The one-celled organism—Amoeba—endures best of all. The lowly things are harmonious wholes ; introduce complexity and specialization, the old harmony is impaired. Man is developed from simpler species, the lower animals. Each upward step has been possible because of an important physical change—a better coordination of mind and body. It is true that in the course of development, sometimes one organ shoots ahead, sometimes another. The central nervous system has out-stripped all others.

Sir Arthur Keithi said : "Civilisation is submitting the human body to a vast and critical experiment. It has laid bare some of the weak points in the human body but the conditions which have provoked them are not of Nature's ordaining but of man's choosing". In 1936, Hawkins speaking before the British Association for the Advancement of Science, said : "The high cerebral specialization that makes possible all these developments and the extraordinary rate at which success has been attained, point to the conclusion that this is a species destined to a spectacular fall more complete and rapid than the world has ever seen".

Let us take the physiologist's account of blood in human body and see what happens to the mind when the physical and chemical balance of the blood is disturbed :

1. Overheat the blood and you rave. And yet men have to work nearly at the raving point in coal mines and boiler rooms, at the mouth of blazing furnaces to produce the things which society demands for its artificial environment.
2. Chill the blood : Bancroft, the famous physiologist, lay naked in an icy room. He described his sensation afterwards. "After a time" he later described "mind gave up the struggle". He was content to lie still and die. He would have died had not his vigilant assistant saved him. His mind ceased to watch over him.

3. Take away oxygen from blood. The mind loses its reasoning ability. The breathlessness at high altitude is due to the nerve supplying the respiratory muscles failing to do their duty because of the want of oxygen.
4. Decrease calcium in the blood by half—Convulsion, coma and then death follows. Double the calcium—the blood thickens so that it can hardly flow. Heaviness, indifference, unconsciousness mark the stages of mind's dethronement ; death is the end.
5. Reduce the amount of sugar in the blood. There is a feeling of "goneness", a blooting out of the mind, then death. Increase the sugar a little, fear seizes the mind : Illusions and diplopia (double vision) ensue, speech becomes thick.
6. Blood is alkaline : acidify it slightly—Coma follows—mind becomes blank Alkalinise the blood, convulsion ensues.
7. Take water from blood : we collapse. Add water : we suffer from headache, nausea and dizziness.

Therefore, change anything in the composition of blood and the mind gives way.

Civilisation changes the environments and thereby the physical and chemical conditions of the blood. Any changes in the environments—such changes as modern civilisation dictates—may be too much for body and hence for the mind. We want to annihilate distance and time with rockets and radio : we want to convert night into day with lamps that are miniature suns : we want to clothe ourselves in fabrics woven from fibres that nature did not provide. All these are incompatible with the survival of man as a species. In us a mind that yearns is at work, but the reward of successful yearning would be extinction. And yet human mind must go on experimenting in developing a quality of mind which curbs the tiger and the ape in him even at the risk of extinction.

Every man has his own worries : some have persecution complexes, suicidal mania, obsessions, indecisiveness, nervous tensions. They become problems to their families, nuisances to themselves, they become ineffective and unemployable in Society. What has happened to them ? In appearance and structure they are indistinguishable from a solid citizen, observe all social conventions, even live an irreproachable life. And yet the affected persons cannot think logically. Why ? In order to explain these phenomena, different parts of brains of animals were either removed or stimulated with electric current. It was discovered that there are centers in the brain which control movements, seeing, hearing swallowing, winking, breathing, sweating and other activities. Effects of injuries to the human brain were also closely studied.

In 1935, a Portuguese Surgeon, Egas Moniz, first suggested that it was possible through Psychosurgery, to operate the brain, to stop worries, phobias and delusions. He had noted how stereotyped were the symptoms of the mentally disturbed patients. There were the same curses and lamentations, the same fury, the same wild looks, the same fits of weeping, the same lack of self-restraint under similar situations, even the same words and phrases were used to express their delusions and fears. It was clear to him that such a fixed pattern of conduct presupposed equally fixed pattern of brain cells that control passions, desires and fears. If the brain cell patterns could be changed, he thought the pattern of conduct could also be changed. How is the brain cell pattern fixed ? By repetitive use. Any idea may become an obsession if it is entertained long enough. But we usually shake them off. Suppose, however the mind is fatigued, the emotions are given no outward expression but are turned inward, and fear takes possession of the mind—the fear of losing a job, the fear of contracting an incurable disease, the fear of being the victim of a plot engineered by individuals. These fears are not so easily shed by

a fatigued mind. Nerve messages flashing over the same pathways again and again involving the same group of cells become fixed as "brain cell" patterns. To effect a cure, new pathways must be formed, new cells must learn how to form new groupings of cell patterns. Egas Moniz proved that fixed ideas could be dissipated by breaking up the link of the groupings of nerve cells through fixed pathways.

Scientists came to learn that the brain of a human being is not one piece, say, like the heart. The brain of an animal has through successive upgrading become the human brain. Nature modified the brain of this animal, enlarged the brain of that, contracted the brain of the third, developed a sense of hearing here and a sense of sight there. Nothing was thrown away. The record of the evolution of brain from the worm through the first toad, bird, dog, horse, ape is packed in the human skull. The work of Egas Moniz in Portugal and of Freeman and Watts in U. S. A. further showed that there is a complete association and interaction between two major parts of the brain in the human being. One is the Thalamus and other is the Cerbrum which completely overlies the Thalamus. The Thalamus is one old component of the animal brain. Every animal from worm upwards has it. It is the seat of raw emotions, desires, passions, hatred, fear, combativeness, love, appetite. This Thalamus is incapable of thinking or imagining. Yet no nervous impulse set up by what we see, hear, feel, touch, taste or smell in the outer world could reach or leave the Cortex of the Brain without passing through the Thalamus. Though the Thalmus cannot think it can colour thinking.

If we had only the Thalamas, we would fly into rage at the slightest irritation, burn up with hate, curl up with fear, woo with ferocity. Why is a bird always happy flying, twittering, fighting, courting, feeding, preening ? Because its brain is largely Thalamus and this Thalamas is subject to little control. It is the enormous roof brain, the Cerebrum and its Cortex which makes Man what he is—the inventor, the philosopher, the moralist, the scientist, the planner. Yet with a Roof Brain alone human existence would probably be impossible. We would be unemotional. We would think without feeling. Never a tear would be shed over the death of a dear friend, never would we sigh in love, never a word of hate would escape us.

Man must balance emotion and reason. The preservation of this balance is a matter of nicely adjusting. Thalamic feeling with Cerebral logic. One wants to drink because of the urge of the Thalamic cells, but the Prefrontal Lobes warn that this would be harmful. The desire to kill on an impulse is Thalamic, the fear of the law is Cerebral. When we yearn, fight, love and strive earnestly to satisfy the emotional needs, the Thalamus is on the ascendancy ; only the prompt assertion of authority by the Prefrontal Lobes restores the poise and keeps us out of jail. Our brains are the battleground on which the old Thalamus and the new Prefrontal Lobe strive for mastery. Cable of nerves, association fibres connect the Prefrontal Lobe with the Thalamus. Impulses flow back and forth over the cables. In mental disorders, the Thalamus overpowers the Prefrontal Lobes and anger, fear, worry, hate, triumph completely over common sense. The brain and nervous system are marvellously adjustable.

I have tried to place before you a short account of some of the research works undertaken by the scientists in the field of Chemotherapy. As a person interested in administration, I have to appeal to the scientists to contribute their share towards the development of the human society, where man may live in peace and in harmony with nature and with other human beings.

Our country is rich in natural resources and minerals as well as in human resources. But we have had yet no detailed statistics or data as to the way in which we can develop these resources for the benefit of the country and her people. It is

admitted that we need heavy industries, we need machine industries and we need consumer goods industries. For all these we need trained technicians. The Planning Commission has estimated that in the Second Five Year Plan we will need thousands of Graduates and Diploma-holders in Civil Engineering, Mechanical Engineering, Electrical Engineering and Chemical Engineering. These men should not only possess the requisite technical knowledge, but should also be capable of utilising the resources that we possess. They should be able to put into use our indigenous raw materials for the great task that lies before us. In Japan I noticed that not only have they adapted the machines imported from abroad for their use, but they have simplified the technical processes in such a way that elaborate training in the use of such machinery is not necessary. While they have utilised highly technical personnel for some industries, in most other industries the ordinary mechanical instruments and gadgets have been discarded and replaced by methods which require manual skill so as to take advantage of their abundant manpower.

There are other directions in which the researches of the scientists may be very fruitful. Apart from securing increased food production or increased quantity of cash crops which would develop our nutrition, and improve our economy, it is important that we should train the agriculturists in improved agricultural techniques. The nature of the soil in an area, the manner in which it is affected by various types of manures, are problems in which research would now be invaluable. As a result of research, traditional methods may have to be discarded and new methods adopted. At the same time there may be something to be learnt from indigenous and traditional practices, It has been my conviction and experience that if there be a disease prevalent in a particular area, the remedy has also been provided by nature in the area, if we have the patience to take the trouble to find it out. On one occasion I went to see a Blackwater Fever case in a part of Assam, where this disease is endemic and scores of people died of it. The treatment of such cases was then a despair to all physicians. On reaching the place I found that the local people used the leaves of a tree which grows locally for curing this type of fever. I got some of these leaves for experimental purposes. The scientists have succeeded in obtaining injectables from the extracts of the leaves and for the last 20 years I have not lost a single case of a Blackwater Fever by using this drug. I could give many instances of this character. Every problem has a solution to be found very near itself.

One sees in life many complex paradoxes. As man goes forward new problems arise. As work goes on new patterns of life emerge. This adventure of life continues. There is no finality about anything. Our ideal today may be a hundred years away from now ; the ideal then will again be a hundred years hence. As we proceed, the target appears to recede and bigger and better targets are formed. The clouds of time may have hidden for us innumerable problems, trials and dangers, yet time may also reveal solutions of unknown difficulties or delightful surprises which man with his knowledge of Science should be prepared to turn to his advantage with faith, hope and goodwill.

DO YOU KNOW ?

Q1. How many world wide lightning flashes are there per day ?

Q2. The current going through air during a lightening strike heats up air up to what temprature ?

ROLE OF NANOTECHNOLOGY IN MEDICINE

A. B. Naik* and N. B. Selukar*

Nanotechnology is a new arena of science and engineering. Nanomedicines, an emerging new field are an outcome of fusion of nanotechnology. Medicine is not a physician's job extensively. The materials and devices designed at the level of nanoscale are for diagnosis, treatment, preventing diseases and traumatic injury, relieving pain, and also in the overall preservation and improvement of health. The experts predict that the maket potential of Nanotechnology will be more than trillion euros by 2015.

INTRODUCTION

This leading edge technology, nanotechnology, makes it possible to alter structures being light, strong and transparent. As is well known "nano" is derived from the Greek word "nanos" (dwarf)-though that "technology" contains the roots "techno" from Greek 'techne'-manmade and 'logy' from Greek logos means to read, literally nanotechology[1] means doctrine of the artificial mastery of tiny things. They are one million times smaller than a pinhead, roughly the same proportion as a golf ball is to the earth. Nanotechnology is based on the scale of nanometer i.e. 1nm = 10^{-9} m.

Prof. Norio Taniguchi coined the term "Nanotechnology" in 1974. Nanotechology is a new arena of science and engineering i.e. a unique mixture of multidisciplinary subjects like Physics, Chemistry, Computer, Biotechnology, Medicine, Material Science, etc. The market prediction by 2015 are (in billion dollars) materials-340, Electronics-300, Pharmaceuticals-180, Chemicals and refining-100, Aerospace-70, healthcare-30, etc. Now nano research is hauling applications into the realms of the possible, which for a long time were just figments of imagination, DVD of the size of coin, particles which shrink tumor, omni-functional sensor technology in cars, nanorobots which repair damaged and diseased tissues nanocoating is transparent scratch resistant and dirt repellent. Thus, it is estimated that there will be no sector of industry, which will not use nanotechnology in future. The experts predict that the market potential of nanotechnology will be more than trillion euros[2] by 2015. Today, nearly half of the European firms are working in this area.

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NANOMEDICINES

One of the fields in which nanotechnology finds extensive applications is nanomedicines, an emerging new field which is an outcome of fusion of nanotechnology. Medicine is no more physician job exclusively. The materials and devices designed at the level of nanoscale are for diagnosis, treatment, preventing diseases and traumatic injury, relieving pain, and also in the overall preservation and improvement of health. Most of the devices used in medicine are carbon based, also known as bucky tube and their sizes are generally ranging from 1 to 100 nm. They are thousand or even ten thousand times smaller than the human hair, which is to be seen with best microscope. Most of the

nanomaterials used in medicine, when injected through the body, pass without being recognized as foreign body by the immune surveillance system. Generally biomimetric in nature, they use the body's natural transport pathways and the natural mechanism of uptake of the drug by the diseased cells. The artificial muscles that would allow their machine to be as a mobile and flexible living creature. Metal platinum is possible to expand and

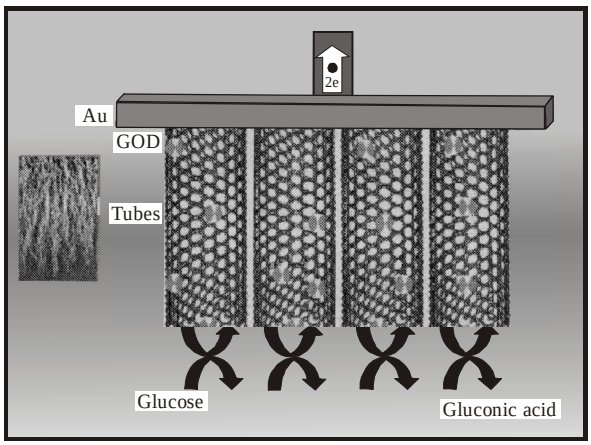

Fig.1 Carbon nanotubes biosensor for glucose detection

contract if electrical charge is applied. The synthesized nanoparticles are linked to biologically active compounds or molecules to be used as probes and drugs to identify and target various abnormal cells in diseased conditions, such as tumor cells and insulin producing cells. It has been possible to develop a nanosized therapeutic drug, called as smart drugs and nanoinsulin pump. It would increase the efficiency of delivering the drug and minimizing the side effects compared to traditional methods. A protein in body acts as building blocks, nano gold particles struck on protein to detect diseases in the form of biological bar code. A nanothermometer is to detect temperature and it is used in anticancer treatment i.e. to kill cancer cell, a quantum dot is also effective. The quantum dots enter in human body to detect and cure existing cancer cells. Now-a-days, nanoshirts have been developed which are used to measure heart rhythm, monitor fluid level, as mosquito repellent and warn about pressure points. Rutledge Ellis-Behnke[3] reported that a tiny fiber save lives by stopping bleeding and aiding recovery from brain injury. Cochlear implant can take over the function of inner ear prosthesis so that deafness is no longer an irreversible fate. The nanoscientists have designed a fluorescent

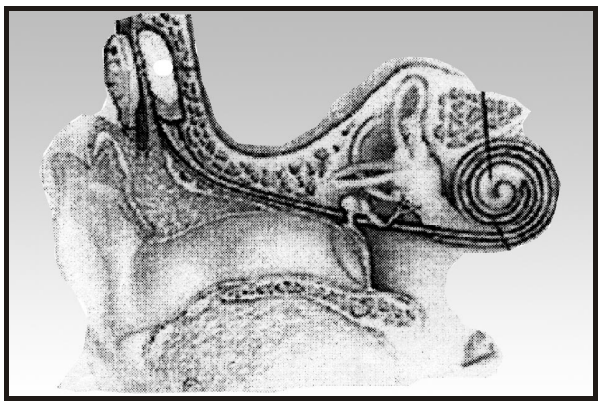

Fig.2 Cochlear implants to stimulate auditory nerves

nanoparticle that lit up while doing MRI/CT scans. It will help in revealing the accurate and precise location of cancerous growth in the body. A body has to protect itself from invasion of foreign substances. This protective role is acted upon by the immune system. Lymphocytes layers of spleen and blood react with nanomedicines for HIV/Viral hepatitis blood cell[4] and reduce the infected white blood corpuscle (WBC) slowly by dual process of pepitization and rejuvenation. The nanocoat and nanodry are effective in migraine headache instantly, improves breathing for asthmatics throughout the day with a single dose. The technologists are developing nanorobots, a several

chemical-binding sites moving freely throughout the body and these will identify the abnormal cells, supply the drugs by coming in contact with these cells.

CONCLUSION :

Nanoscience, nanotechnology and nanomedicines have large interconnectivity and together they have potential for fast realization of products from nanomedicines. Thus, Nanomedicines would provide valuable, better and safer treatments for the human beings.

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DO YOU KNOW ?

Q3. What are the sources of flyash and redmud ?

Q4. One gram of dirt can harbour how many microbial species ?

THE GENIUS OF DARWIN : TWO HUNDRED YEARS

Sisir K. Majumdar*

This article is a humble tribute to the genius of Charles Robert Darwin (1809-1882) in his bicentenary birth anniversary. Darwin's theory of evolutionary biology by natural selection (1859) is, though accepted by the majority scientific community, not accepted universally. Here an attempt is made to analyse the impact of Darwinism on various other aspects–sociological, theological, cultural, economic, etc., of the day, and till today. There are still many unanswered questions. In his evolutionary theory, the "missing link" between apes and humankind or between man-apes and apes-man is still missing. The debate continues.

INTRODUCTION

There is a popular misunderstanding that "evolution" and "creation" are contradictory terms. Evolution simply means, change over time while creation is just the act of formation over time. The two terms are, therefore, complementary and not contradictory.

Evolution is a gradual directional change, now most commonly used to refer to cumulative changes in the characteristics of population of organisms from generation to generation. Evolution occurs by the fixation of changes (mutations) in the structure of genetic material, and the passing on of these changes from ancestor to descendant. This is well demonstrated over geological time by the sequence of organisms preserved in the fossil record. There are two opposing schools of thought regarding the pattern and tempo of evolution.

The gradualist school is based on a model of evolution in which species change gradually through time by slow directional change within a lineage, producing a long graded series of differing forms. The punctuated equilibria school, on the other hand, is based on a model in which species are relatively stable and long-lived in geological time, and that new species appear during outbursts of rapid speciation, followed by the differential success of some of the newly formed species.

Speciation is the process by which a species does not merely change its characteristics over time, but actually splits into two or more species which are no longer capable of interbreeding with the parent stock or one another and, consequently, go their separate ways.

PEEP INTO THE PAST

Where we have come today in the trail of our evolution is not important ; what is important is how we came to, where we are today in the tree of our creation. This question has been asked by many since ancient times.

A chinese philosopher—Tson Tse by name—wrote in the sixth century B. C. i.e. about the time of Buddha :

"All organisms have originated from a single species. This single species had undergone many gradual and continuous changes and then gave rise

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to all organisms of different forms. Such organisms were not differentiated immediately but, on the contrary, acquired their differences through gradual change, generation after generation." (Quoted from Jawharlal Nehru : Glimpses of World History—"Darwin and the Triumph of Science" (Feb, 3, 1933) p. 525-526, Oxford University Press, New Delhi, 1982).

Amazing observation by the old Chinese biologist and philosopher :

All traditional religions—Hinduism, Christianity, Islam and so on have propagated the supremacy of the supernatural—"God" who created man in his own image. Biblical account puts creation of the world just 4004 years before the birth of Christ. Indian (Hindu) mythology, however, measures time in enormous periods, like the geological periods. But, the conclusion on the creation of man and the universe was no different in any orthodox traditional faith.

Ancient Greek philosophers, like Hippocrates (460-377 B. C.), Father of Rational Medicine and Aristotle (384-324 B. C.) were interested in the development of living organisms. Empedocles of Agrigentum (504–443 B.C.), Sicily, considered that "the creatures survived, being accidentally compounded in a suitable way ; but where it did not happen, the creatures perished and are perishing still."

DARWIN AND EVOLUTION

Charles Robert Drawin (1809–1882) was not the first to propose the theory of evolution ; he was the first to propose a scientific mechanism for the process of evolution and to provide an over-whelming amount of organized evidence in support of it. He formulated the theory of evolution by means of natural selection following a five-year voyage (1831-1836) around the world aboard the H.M.S. Beagle. He published his theory–"On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life" in 1859-a book that shook the Christian world of the day. The debate still continues. He then worked on a series of suplemental treatises, including "The Descent of Man" (1871), which postulated the descent of the human race from the anthropoid group. He is remembered primarily as the leader of evolutionary biology. He wrote many other works on plants and animals.

The idea of evolution was not novel. In fact, during the 1770's Darwin's own grandfather–Erasmus Darwin (1731–1802)–a physician, had published a book discussing the concept. But no probable method was proposed, and there was not enough factual evidence to support the theory. More importantly, acceptance of evolution required the abandonment of strict biblical teaching in Victorian England. That was out of the question at the time.

Though it is acclaimed as one of the great classics of scientific literature, Charles Darwin's "On the origin of species" was written in a way that can be understood by a wide general audience.

Drawin's theory is based on observable facts. It was the way in which he related them to each other that made it so unexpectedly different and valuable. The basis of the theory was the following.

(i) Species are made up of variable populations.

(ii) Variation is maintained by sexual reproduction.

(iii) Individuals produce more eggs or seeds than are needed for the species to survive.

(iv) Individuals that are well adapted to their environment will be more likely to survive and reproduce thereby passing on their traits to succeeding generations.

The theory of population control of the English economist and cleargyman–Thomas Robert Malthus (1766–1834) in his book–"Essay on the Principle

of Population (1798, Revised 1803) influenced Darwin's thinking on natural selection as the driving force of evolution. According to Malthus, population increases by geometric ratio (1, 2, 4, 8 ... with increasing difference) while food supply increases by arithmetic ratio (1, 4, 7, 10 ... with constant difference). Darwin was an acute observer of living things around him and a meticulous recorder of what he observed.

Darwinism is synonymous with evolution to most people, but not universally. Darwin's theory so captures the imagination that it continues in popular culture and to stretch scientific thought. From behavioural studies of our closest living relatives in the animal kingdom to genetic engineering, the principles of evolution are bing employed for the benefit of mankind and the environment. Mendelism—the theory of heredity, propounded by Gregor Johann Mendel (1822–1884), adds strong support to the theory of Darwin. Darwin's influence reaches ever widening fields of research as we continue to seek the answer to that still fascinating "mystery of mysteries" : the origin of living things.

Neo-Darwinism is the modern theory of evolution built up since the 1930's integrating Darwin's theory of evolution through natural selection with the theory of genetic inheritance founded on the work of Gregor Mendel–the Austrian monk. In fact, genetics of Mendelism provided the sinews of evolutionary biology.

Genetics now regulates everything in the biological world. A gene is a region of Deoxyribo-nucleic acid (DNA) that provides the body's instructions for building life. Genes make up only three percent of DNA. The remaining 97 percent "junk DNA" may help move genes around. Most gene mutations (change) appear in males. If our DNA is laid end-to-end, it would reach the sun and back more than 600 times.

Between 1920 and 1935 mathematicians and experimentalists began laying the groundwork for a theory combining Darwinian evolution and Mendelian genetics. The Russian-American geneticist and evolutionist–Theodosius Grigorevich Dobzhansky (1900–1975), in his book–"Genetics and the Origin of Species" (1937) proposed the first substantial synthesis of evolutionary biology and evolutionary genetics. "Nothing in biology makes sense except in the light of evolution", he wrote.

Darwinism is synonymous with evolution. In the scientific community, evolution by natural selection is a fundamental unifying theory of all the life sciences.

GLOBAL IMPACT OF DARWINISM

Ancient Indians, unlike other ancient nations, had conception of vast space and time. Even Indian mythology deals with ages of hundreds of millions of years. To Indians, the vast periods of modern geology or the astronomical distances of stars would not have come as a surprise. Because of this background, Darwin's and other similar theories could not create in India the turmoil and inner conflict, which they produced in Europe in the middle of the 19th century. The popular mind in Europe was used to a timescale which did not go beyond a few thousand years.

THE MISSING LINK

"Missing Link" is the hypothetical extinct creature in the evolutionary line between modern man and his anthropoid progenitors. In the latter half of the 19th century, a common misinterpretion of Darwin's work was that man has lineally descended from existing species of apes. To accept this theory and reconcile it with the hierarchial "great chain of being", some fossil ape-man or man-ape seemed necessary to complete the chain. "Piltecanthro pus erectus" (now *Homo erectus*), "Eoanthropus dawsoni" (the Piltdown man hoax) and even the modern Hottentots of Southern Africa (when newy discovered) were suggested as the missing link. Today it is recognized that man's

relationship to the present anthropoid apes (e.g. chimpanzees) is through common ancestors rather than through direct descent.

However, Darwin concluded his seminal book—"The Descent of Man" with the following words : "....Man still bears in his bodily frame the indelible stamp of his lowly origin."

The question of our origin still remains open. Time will tell. The relegation of the human by the theory of evolution by natural selection to the status of advanced apes has led to moral and ethical objections over its implied justification of selfish and even barabaric behaviour.

SOCIAL DARWINISM

Darwin's theory of evolution was concerned with the origin and development of species. But this did not explain in any way human social relations.

However, social Darwinism is a 19th century theory of socio–cultural evolution, deriving its name from its relation to the biloigical theories of Darwin. The idea that life of man in society was a struggle for existence ruled by "survival of the fittest"–a phrase proposed by the English evolutionary philosopher scientist and sociologist, Herbert Spencer (1820–1903) in his "Principles of Biology", 1864 (Vol. I, p. 444) and was not introduced by Darwin, but his work gave it the force of natural law.

The social Darwinists–notably Spencer, British economist and political theorist, Walter Bagehot (1826–1877) and others–belived that the process of natural selection acting on variations in the population would result in the survival of the best competitors and in continuing inprovement in the population. Societies, like individuals, were viewed as organisms that evolve in this manner.

The theory was used to support political conservatism. Class stratification was justified on the basis of "natural" inequalities among individuals, for the control of property was said to be a correlate superior and inherent moral attributes such as industriousness, temperence and frugality. An attempt to reform society, politically, socially, culturally and economically, would, therefore, interfere with natural processes ; unrestricted competition (as in globalized market economy) and defence of the status quo were in second with biological selection. The poor and the underprivileged were the "unfit" and should not be aided ; in the strugle for existence, wealth was a sign of success. At the societal level, social Darwinism was used as a philosophical rationalization for imperialist and racist policies, sustaining belief in Anglo-Saxon or Aryan cultural and bilogical superiority.

Social Darwinism declined during the 20th century, as an expended knowledge of biological and cultural phenomena undermined, rather than supported, its basic tenets. Evidence shows that natural selection does not necessarily favour the most competitive or agressive individual, that distinction must be made between learned and inherited characteristics, and that social evolution has not proceeded in a single straight line.

Mapping of Human Genome (Book of Life) completed on June 26, 2000, inflicted the final death nail into the corpus of Social Darwinism. There is no single genome sequence that defines everyone. Ther are no two humans, other than identical twins, who share identical genome. Though genomes are 99.98 percent identical, each individual is unique. Genetial anthropology has ushered in a new understanding of our evolutionary history. It has established the rational basis of relatedness among humans, irrespective of race, colour, religion, culture, ethnicity an other aspects of life. It has totally demolished the very concept of superiority of one humankind over another. The concept of "Eugenics"–a term coined in 1883 by Darwin's cousin, Francis Galton (1822–1911) as "the science

which deals with all influences that improve the inborn qualities", has been consigned to the dustbin of history. Eugenics is non-scientific, illiberal and inhumane. There is 99.9 percent similarity between any two randomly chosen persons out of more than 6 billion people on this planet earth. It has established equality among humankind on a scientific basis for the first time. Genetical variability is more in intragroup than in inter-groups. New genetics has shattered the myth of racial superiority of Anglo-Saxons, Aryans or whoever. Social Darwinism is dead for ever.

THE EPILOGUE

Evolution of humans from ancestral primates is complex. The African apes (gorilla and chimpanzee) are shown by anatomical, molecular, cellular and genetic comparisons to be the closest living relatives of humans. The oldest hominids (of the human group), the Australopithecines, found in Africa, date from 3.5–4.4 million years ago. The first to use tools came 2 million years later, and the first humanoids to use fire and move out of Africa appeared 1.7 million years ago. Neanderthals (found in Germany in 1856) were not direct ancestors of the human species. Modern human are all believed to descend from one African female of 200,000 years ago, although there is a rival theory that humans evolved in different parts of the world simultaneously.

The theory of evolution is still a riddle wrapped in mystery inside an enigma. The final word has not yet been said. That is how science advances. This very fact needs to be stressed emphatically in the bicentenary birth anniversary of Charles Robert Darwin—the greatest genius that the world has ever produced. The debate continues.....

"Dust in the air suspended marks the place where a story ended."

[Thomas Stearns Eliot (1888–1965), Nobel Literature Laureate, 1948 : Four Quartets–Little Gidding, 1942.)

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APPENDIX

CHRONOLOGY AND PUBLICATIONS OF CHARLES DARWIN

1809	Charles Darwin is born on February 12 in Shrewsbury, England.
1818	Enters Shrewsbury School.
1825-27	Studies medicine at Edinburgh University, Scotland-Never completed.
1828-31	Studies Theology to become a Church minister at Cambridge University, England.
1831-36	H.M.S. Beagle voyage around the world.
1839	Marries his first cousin–Emma wedgwood (1808-1896) Had ten children (only seven of whom survived infancy).
1839	Publishes The Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle under the Command of Captain Fitzroy, R.N. from 1832 to 1836. The Royal Society of London elects Darwin a Fellow. Awarded Copley Medal, 1864.
1842	Moves to Down House, Kent, and writes first 35-page draft outlining theory of evolution.
1844	Writes 230-page essay outlining his ideas regarding the origin of species.

1846-54 Studies barnacles (a marine crustacean attached permanently to underwater surfaces).

1858 Receives Alfred Wallace's (1823-1913) essay. Papers on evolution by Wallace and Darwin both are read to the Linnean Society. Darwin's priority is established. Never received formal recognition from the British Government.

1859 Publishes on the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. All 1,250 copies sold on the first day.

1860 Huxley-Wilberforce debate takes place at Oxford University.

1871 Publishes The Descent of Man and Selection in Relation to Sex.

1872 The Expression of Emotions of Man and Animals.

1875 Insectivorous Plants.

1875 The Movements and Habits of Climbing Plants.

1876 Autobiography for his children.

1882 Dies of heart attack on April 19 in Kent and is buried at Westminster Abbey, London, near Isaac Newton (1642-1727).

DO YOU KNOW ?

Q5. Which country has 11 different time Zones ?

Q6. During the free fall of sky drivers, what terminal velocity they generally experience ?

VULTURES : NATURE'S INCINERATORS

Amita Kanaujia*, Sonika Kushwaha

The status of vultures in and around the Indian sub-continent has suddenly come into the spotlight. Vultures, which are considered nature's most efficient scavengers, are on the verge of extinction. Throughout the ages, vultures have been revered as symbols of power and insight. They perform a vital role in nature's sanitation processes by tearing meat from carcasses before it rots. Nature's disposal squads or "incinerators", these vultures are now vanishing from Indian skies at an alarming pace due to a number of reasons. Diclofenac, a widely used medicine for both humans and livestock of the non-steroidal anti-inflammatory group of drugs (NSAIDS) has been identified as the main cause responsible for the vulture toll. The Indian Government banned Diclofenac in March 2006. A number of captive breeding centre are being established in India and other countries for the endangered species.

INTRODUCTION

In the past centuries man has altered the world he lives in. This has resulted in the destruction of some of the animals in a habitat and increase in the populations of some others. A recent example of this is the decline in *Gyps* vulture populations in India and its neighbouring countries. Ecological extinction of *Gyps* vultures in India is also leading to further changes in the species complement of scavengers. Important zoonotic diseases, such as rabies and bubonic plague, which are endemic within India and for which dogs and rats respectively, are the primary reservoirs, are likely to increase. Wildlife and domestic livestock may also be at increased risk from dog and rat-borne pathogens. Vultures probably also help to control livestock diseases such as brucellosis, tuberculosis, and anthrax by disposing of infected carcasses[1]. In 2006, it was stated that vultures have been dying on a big scale due to diclofenac poisoning. Diclofenac injection is widely used in cattle and other animals as an effective anti-inflammatory and pain relieving medication. When such animals die vultures attack the carcasses of these animals and the residual diclofenac from these dead animal tissues causes widespread lethal renal failure in vultures. Identifying the cause of the Asian vulture decline gives hope to the many conservationists working to save these Critically Endangered species. This includes BirdLife Partners such as the Bombay Natural History Society, Ornithological Society of Pakistan, Bird Conservation Nepal and the RSPB (Royal Society for Protection of Birds). Other conservation organisations working hard alongside BirdLife include the Zoological Society of London (ZSL), and the Peregrine Fund.

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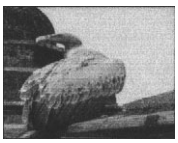
Table : General Data of Vultures

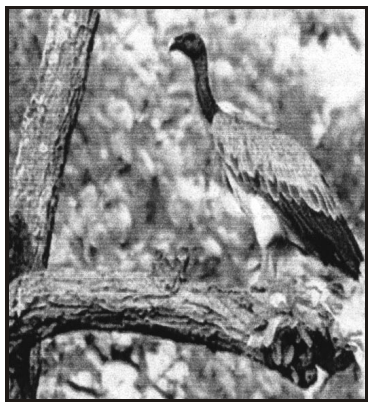
COMMON NAME	ZOOLOGICAL NAME	DESCRIPTION	VOICE	DISTRIBUTION	CURRENT STATUS
Lammergeier (Bearded Vulture)	*Gypaetus barbatus*	125 cm, Huge, grey and orange raptor with long wedge-shaped tail.		Common breeding resident in high northern mountains. Also occurs in S Europe, Africa and W, central & E Asia	Uncommon
Egyptian Vuture	*Neophron percnopterus*	65 cm, medium sized, dirty-white raptor with a wedge-shaped tail.		Fairly common throughout region. Also occurs in S Europe, Africa and W, central & E Asia.	Fairly common
Oriental White- backed Vulture	*Gyps benegalensis*	85 cm, dark, broad-winged raptor with large white back patch. Tail is short.		Globally threatened. Most frequent in northern wildlife sanctuaries and now very scarce in towns.	Critically endangered
Indian Vulture (Long-billed)	*Gyps indicus*	90 cm Large, pale brown raptor with dark flight feathers and short tail.		Globally threatened. Most frequent in large wildlife sancturaries	Critically endangered
Himalayan Griffon	*Gyps himalayensis*	125 cm, huge, pale raptor with tail short. Flight feathers are black.		Common breeding resident of high mountains. Also occurs in Central Asia.	Uncommon
Eurasian Griffon	*Gyps fulvus*	100 cm, huge, rufousbrown, white head and neck, dark flight feathers and tail.		Common breeding resident western Pakistan & norther Pakistan & northern India & Nepal. also occurs in S. Europe, Africa and W, central & E Asia.	Uncommon
Cinereous Vulture	*Aegypius monachus*	115 cm, huge, chocolate brown raptor with a blackish face mark. Short, often wedge-shaped tail.		Mainly scarce winter visitor to northern mountains and river valleys.	Uncommon, near threatened
Red-headed Vulture (king, Black Vulture	*Sarcogyps calvus*	85 cm, large blackish raptor with red head and neck.		Scarce but widespread breeding resident throughout the lowlands.	Uncommon, near threatened

DISTRIBUTION AND HABITAT

Vultures, comprise two groups of large diurnal birds of prey (Falconiformes), not closely related to each other. Old and New World Vultures are among the world's best examples of "Convergent Evolution". There are 22 kinds of vultures which includes 15 types of Old world vultures and 7 types of New World vultures. There are nine species of vultures found in India.[3] King vulture (*Sarcogyps calvus*), Cinereous vulture (*Aegypius monachus*), Griffon vulture (*Gyps fulvus*), Himalayan Griffon vulture (*Gyps himalayensis)*, Long-billed vulture (*Gyps indicus*), Slender-billed vulture (*Gyps tenuiroustris),* white-backed vuture (*Gyps bengalensis*), Egyptian Vulture (*Neophron percnopterus*), and Bearded vulture (*Gypaetus barbatus*). New World vultures belong to family Cathartidae, which is quite close to storks. These now range from Canada to Tierra del Fuego, southern South America. Several species have a good sense of smell, unusual for raptors. Since vulturs mainly feed on the corpses of large mammals, they do not live in places like Madagascar, Ceylon, and Malayan Islands or Australia where there are no herd-forming mammals of the open country.[4]

The old World vultures found in Africa, Asia and Europe belong to the family Accipitridae, which also includes eagles, kites, buzzards and hawks. They find carcasses exclusively by sight. Long-lived, they have low reproductive rates, high adult survival and a low juvenile survival. They are also highly sensitive to environmental changes.

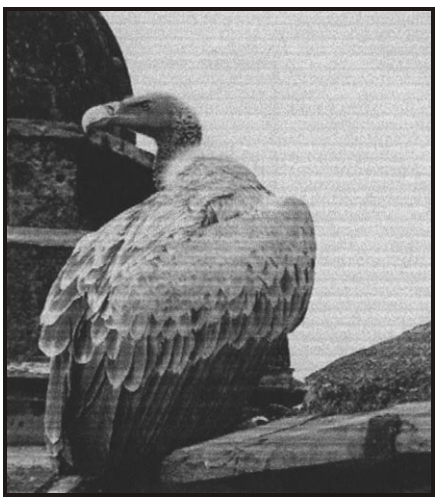
There are a total of nine species of vultures found in South Asia. Four of the Gyps vulture species are only found in Asia. These are oriental white-backed Vulture *Gyps bengalensis,* Long-billed Vulture *Gyps indicus,* Slender-billed Vulture *Gyps, tenuirostris* and Himalayan Griffon Vulture *Gyps himalayensis.* Eurasian Griffon Vulture *Gyps fulvus* breeds in Eurasia but migrates to Africa and South Asia. The geographic ranges of these vultures overlap. The Oriental White-backed Vulture *Gyps bengalensis* prefers cultivated tracts with scattered houses and refuse tips offer more opportunity for obtaining food Griffon vultures *Gyps* sp., are responsible for a greater consumption of meat than any of the mammalian carnivores.



Slender billed vulture
(Photo Courtesy : BCN)

White backed vulture
(Photo Courtesy : Wikimedia Commons)

The Egyptian Vulture

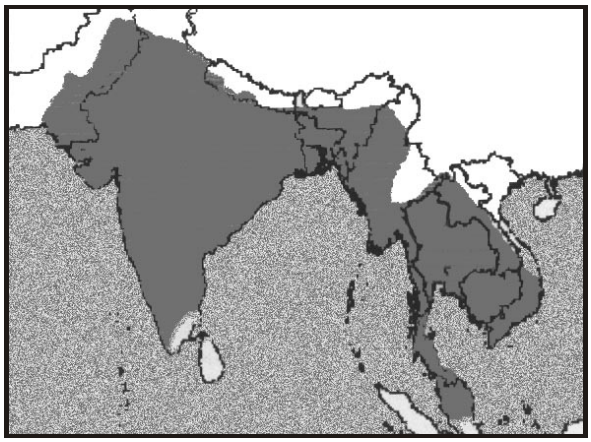


Long billed vulture
(Wikimedia : Dezidor)

Range & Population of *Gyps bengalensis :* Pakistan, India, Bangladesh, Nepal, Bhutan, Mayanmar, Thailand, Laos, Cambodia and southern Vietnam, and is extinct in southern China and Malaysia.

Previously widespread and abundant across its range, it disappeared from most of South-East Asia in the early 20th century and now only occurs locally. Since 1996, it has suffered a catastrophic decline (over 95%) in its remaining strongholds in Pakistan and India, although flocks are still present locally. It is described as 'still common' in Shan State (Myanmar). It is very rare in southern China.

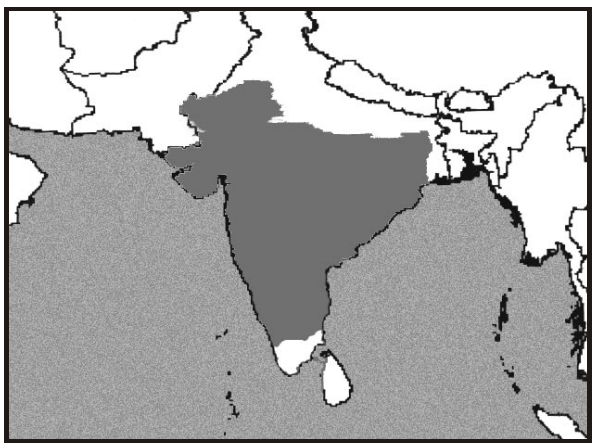
Population estimate	Population trend	Range estimate (breeding/resident)
2,500-9,999	decreading	4,917,000 km^2



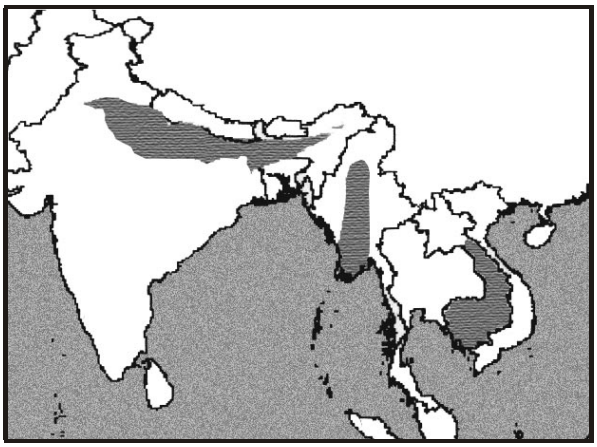
Range & population of *Gyps indicus :* Peninsular India south of the Gangetic plain, north to Delhi, east through Madhya Pradesh, south to the Nilgiris, and occasionally further south.

It was common until very recently, but severe population declines (>90%) have been noted since the late 1990s.

Population estimate	Population trend	Range estimate (breeding/resident)
2,500-9,999	decreasing	1,693,800 km^2



Range & population of *Gyps tenuirostris :* In **India** north of, and including, the Gangetic plain, west to at least Himachal Pradesh and Haryana, south to southern West Bengal (and posible northern Orissa), east through the plains of Assam, and through southern **Nepal,** north and central **Bangladesh,** and **Myanmar** (except the north).



It was once common, but in South-East Asia populations declined through the latter half of the nineteenth century and the first half of the twentieth century, and are now probably very small and restricted in distribution. Small numbers were recorded during a recent survey in Shan State (Myanmar). In India and Nepal, the species was common until very recently, with very sharp population declines noted in the last few years

Population estimate	Population trend	Range estimate (breeding/resident)
2,500-9,999	decreasing	1,693,800 km^2

IMPACTS OF DECLINE

Throughout their range, in both in new and old world, vultures fulfil an important ecological role, and their absence could cause ecological imbalances. For example, in Africa vultures keep natural and man-made habitats free of carcasses, waste and even human excrement.[5] Vultures have an important role in the natural environment. If it weren't for vultures, many parts of the world would look like junkyards of bones and rotten meat. They are nature's disposal squads or **"incinerators".**

Vultures provide the society with a number of 'services', most notably disposal of carrion. These services have an impact on human health, economic activity and on environmental quality. An overview of these impacts is provided below.

1. Human Health

An increase in uneaten carcasses poses a direct threat to human health because the carrions provide a breeding ground for potentially pathogenic bacteria leading to the possibility of direct or indirect infections and are sources of disease, such as anthrax. In removing carcasses rapidly and efficiently, vultures cleanse the environment and protect humans, livestock and wildlife from infections and other disease and do it absolutely free ! A fall in the vulture population could result in an increase in feral dog population, which in turn could increase the incidence of animal bites and rabies among humans. In India, the Hindus (about 80% of the population) do not eat cattle which they regard as sacred. Muslims in Pakistan believe that livestock which die of natural causes are unfit for human consumption and are then left in dumps for scavengers. In both countries, without the natural disposal of carcasses by vultures, the number of rotting animals would increase. Also the loss of vultures might contribute to environmental pollution (air and water) resulting in the increased incidence of anthrax and water borne diseases among people. They come to the rescue of man to dispose of carcasses when animals die during natural calamites such as floods, storms, drought and war.

2. Costs of Industry :

Important economic impacts of vulture decline include the costs to villagers of disposing of

carcasses and to collectors of cattle bones for the fertilizer indisutry. The latter is an old trade among India's poor ; vultures effectively and rapidly clean skeletons of all soft material and facilitate the bone collector's job, whilst feral dogs cannot serve as substitutes to vultures because they only scavenge choice tissues. This and the attempted burning of carcasses in some localities, remove a source of income for the bone collectors.

3. Economic impact :

Environmental economists have developed a number of valuation techniques useful to place monetary values on services and goods, such as vulture, that are not directly traded in any market.[6] Within a framework for the monetary valuation of health effects, the two strains of human health effects due to the fall in vulture population could be identified in morbidity and mortality effects.

4. Recreation :

Other important benefits society might receive from the protection of vultures derive from the pleasure people might receive by viewing them, or by simply knowing that the species continue to live in its natural habitat on a sustainable level. For example, several tour operators offer bird watching tours in India to admire vultures.

5. Existence Value :

The values placed on vultures may include values on the option of viewing or bequest values for future generations. Such values may be those of people inside and outside of India. Charity collections, such as those raised by the RSPB (Royal Society for protection of Birds) in response to vulture declines, may be able to capture some of these values.

6. Cultural and Religious Values

Vultures, are important for their considerable cultural and religious significance that some communities attach to their role of disposing of human bodies. For thousands of years and in different parts of the world, humans have laid out their dead for consumption by vultures. In India, vultures have religious and spiritual significance for Parsees and Hindus. Parsees dispose dead bodies by offering them to vultures as for example Towers of silence in Mumbai. They consider the burial or burning of human remains to defile the elements[7]. The extinction of vultures has denied the Parsee population their traditional way of disposing their dead. The consequential impacts include :

- loss of welfare in terms of spiritual benefits of knowing that their remains will be disposed of in a way consistent with Zoroastrian faith, which does no allow defilement of the dead and the fact that the Parsees cannot cremate, bury or submerge their dead in water as they consider a corpse impure ;
- additional costs of disposal of remains, example the use by the orthodox Community of solar reflectors to hasten decay of the bodies or the creation of "vulture centres" to enable disposal in keeping with tradition. In Mumbai 8 solar concentrations, amount to Rs.1.6 million.

Thus the impacts of the extinciton or near extinction of the *Gyps* vultures in India may be significant in terms of the spiritual well-being of the Parsees both in India and abroad.

7. Other environmental inpacts :

Wider environmental impacts may include increase in scavenger population other than feral

dogs and water pollution due to the fouling of watercourses by rotting carcasses. Vultures also help to control livestock diseases such as brucellosis, tuberculosis, and anthrax by disposing of infected carcasses. The dying out of the vultures would be an irreplaceable loss of a link in the food chain.

Increase in other scavenger population may have significant socio-economic impacts. Rats, feral cats and other species may increase in numbers leading to spread of disease. The spread of rabies is largely attributable to dog populations, but increases in prevalence rates of other diseases may be an issue. It shows that there was marked increase in the dog population during 1987-1997 coinciding with the period of decline in the vulture population. The population has increased further since 1997, with it being estimated that there were over 29 million dogs in India in 2003. A vulture consumes an average of 0.5 kg/day, while a healthy dog is estimated one fifth of its body weight a week, or about 5 kg. This implies that one vulture less would increase food availability for 0.7dogs.

The increase in mammalian scavengers at carcasses may have unknown ecological consequences. Most scavengers are also predatory, and increase in their population as a result of the abundance of carrion is likely to lead to higher predation pressure on wildlife such as mammals, gorund-nesting birds, reptiles, and amphibians.

CONSERVATION MEASURES PROPOSED

- Collect baseline data on vulture populations at selected sites throughout India, including neighbouring countries. Monitoring sites should be established at key breeding localities throughout India especially the three *Gyps* species. This monitoring programme should be simple, coordinated, systematic and cost-efficient.
- Surveillance of the health of vultures, particularly *Gyps* species, initially by means of observations but also by non-invasive monitoring (laboratory examination of faeces, dropped feathers, etc.) opportunistic sampling (of dead vultures) and the traping of live vultures for the collection of blood samples and ectoparasites. Faeces should be examined for potential pathogens (Salmonella, Anthrax, *Clostridium perfringens*), parasites (nematodes, cestodes, trematodes, coccidia) and viruses (negative stain electron microscopy and perhaps virus isolation for normal flora viruses). Blood analyses should be conducted for intra and extra-cellular hemiparasites, complete blood counts, serum chemistry panels, toxicology (especially heavy metals) and serology tests for antibodies to infectious diseases (particularly for bacteria and viruses that are pathogens for domestic fowl and any known major disease of wild birds.) Serum of both healthy and ill vultures should be collected for retrospective studies. This protocol will be determined by information gained from present studies in southern Asia.
- All vulture mortalities should be documented, post-mortem examinations conducted (to identify birds with gout and other clinical signs). Epidemiological data should be collected.
- The behaviour of vultures should be recorded, especially abnormal behaviour and "head-drooping" (this should be related to environmental conditions), and documented.
- Several Indian "committees" comprising specialists from different fields should be established. The main aims should be collection of monitoring data with the different Indian research and monitoring initiatives.
- Public awareness and Public support programmes should be implemented in India.

The main aims should be to improve the awareness of people about the important role of vultures and the potential impact of negative factors on their survival.

- Diclofenac was banned in March 2006 by the Indian Government. In May 2006, the Drug Controller General (India) ordered the withdrawal of all licences granted for the manufacture of diclofenac for veterinary use within India. However, there is no accepted method for monitoring the effectiveness of this ban in terms of its impact on vultures.[8] Therefore, it is necessary to gain Governmnt commitment to control veterinary use of dicolofenac, and support species management or restoration, as needed.
- Urgent need is to identify the location of all remaining breeding colonies of each species. This information will help the various conservation groups, National governments, non-governmental organizations, and individuals to prevent their extinction.
- Measure the frequency of diclofenac treated carcasses available to vultures.
- Study the overall number and distribution of wild animals, potential food source for vultures, the present condition of live-stock breeding in India, the number and distribution of domestic animals, historical trends and their use in food industry.
- Establish a study group to coordinate collection and analysis of data and compile an action plan for Asian vultures.

CONCLUSION

Thirty years ago raptor populations in the Northern-Central India as a whole and within Delhi in particular appeared to be the highest in any urban area, world wide. Although diclofenac has been identified as the sole cause of vulture decline, data of survey work reveal that other factors such as lack of food availability and habitat loss are also responsible for the declining vulture population. Banning of diclofenace and conducting of surveys and research work is not sufficient to ensure self-sustainability of these populations. The urgent need is to educate, inform and involve the localites and children in the awareness of the plight of rare and critically endangered species. The involvement of future generation will surely show positive results.

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SOLID WASTE MANAGEMENT : A STUDY OF DISPOSAL OF MUNICIPAL SOLID WASTE

V. Vijay Durga Prasad*

Increasing industrialization, urbanization and changes in the pattern of life give rise to generation of increasing quantities of solid waste leading to increased threats to the environment. Solid waste includes household garbage, rubbish, construction and demolition debris, sanitation residues, trade and industrial refuse and bio-medical solid waste. Solid Waste Management (SWM) has three basic components, namely, collection, transportation and disposal. The objective of SWM is to reduce the quantity of solid waste disposed off on land by recovery of materials and energy from solid waste in a cost effective and invironment friendly manner. As per Muncipal Solid Wastes (Management an Handling) Rules, 2000 (MSW Rules) of Central Pollution Control Board (CPCB), every muncipal authority is responsible for collection, segregation, storage, transportation, processing and disposal of the municipal waste. In light of the above mentioned scenario, the paper focuses on the practices of disposal of solid waste adopted by the Vijayawada Municipal Corporation (VMC) in Vijayawada City (Andhra Pradesh).

INTRODUCTION

Solid waste management in India is a part of public health and sanitation, and according to Indian Constitution, falls within purview of the State list. Since this activity is non-exclusive, non-rivalled and essential, the responsibility for providing the service lies within the public domain. The activity being of local nature is entrusted to the Urban Local Bodies (ULBs). The ULB undertakes the task of solid waste service delivery with its own staff, equipment and funds, in some cases, works are contracted out to private enterprises. Scientific and integrated Solid Waste Management (SWM) is a relatively new concept in India, although the initiatives of Government of India (GoI) began as early as in the 1960s when the Ministry of Food and Agriculture offered soft loans of ULBs for SWM. Further initative was taken by the GoI in terms of planned support by providing black grants and loans to state governments for setting up Municipal Solid Waste (MSW) composting facilities under the fourth five-year plan (1969-74). This initiative was taken further in 1974 when the GoI modified this scheme for specific support to cities with above 30 lakhs population. However, a number of reasons led to failure of the above initiatives.

MANAGEMENT OF MUNICIPAL SOLID WASTE

The Manual on Municipal Solid Waste Management (2000) groups activities associated with management of MSW into six functional elements : (a) waste generation ; (b) waste handling and sorting, storage and processing at source ; (c) collection ; (d) sorting, processing and transformation ; (e) transfer and transport ; and (f) disposal MSW (Management & Handling) Rules, 2000 (MSW Rules) are applicable to every municipal authority responsible for collection,

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segregation, storage, transportation, processing and disposal of municipal solid. The Rule contains four Schedules namely, **Schedule–I :** Relates to implementation Schedule ; **Schedule–II :** Specifications relating to collection, segregation, storage, transportation, processing and disposal of municipal solid waste (MSW) ; **Schedule–III :** Specifications for landfilling indicating site selection, facilities at the site, specifications for landfilling, pollution prevention, water quality monitoring, ambient air quality minitoring, plantation at landfill site, closure of landfill site and post care ; **Schedule–IV :** Indicate waste processing options including ; standards for composting, treated leachates and incinerations.

TECHNOLOGIES AVAILABLE FOR MUNICIPAL WASTE DISPOSAL

There are six ongoing waste management schemes/programmes/projects in India. While two of these projects concentrate on composting and recycling, four concentrate on waste-to-energy projects. The earlier study includes the Bangalore model and the Jaipur model. For waste-to-energy projects, facilities in Lucknow, Hyderabad, Vijayawada and Nagpur have been studied. The studies also highlight on the environmental and cost sustainability of these projects/programmes. Inputs from these studies have been used to develop pilot cases, along with their cost and financing options ; these are outlined in the following chapter. In order to facilitate understanding of the technologies used in these eight cities, short write-ups on some of the technologies used/available have been outlined below. Merits and demerits of some of these technologies are also outlined to assist any policy maker in identifying the best alternative solution to waste disposal depending on local conditions.

(1) Composting :

Composting is defined as a controlled process involving microbial degradation of organic matter. There are various types of composting, but they can be categorised into three major segments– aerobic composting, anaerobic composting and vermicomposting.

(a) Anaerobic Composting :

In this form of composting, the organic matter is decomposed in the absence of air. Organic matter may be collected in pits and covered with a thick layer of soil and left undisturbed for 6-8 months. The compost so formed may not be completely converted and may include aggregated masses.

(b) Aerobic Composting :

A process by which organic wastes are converted into compost or manure in presence of air is aerobic composting which may be of different types. The most common is the *Heap Method* where organic matter needs to be divided into three different types and need to be placed in a heap one above the other, covered by a thin layer of soil or dry leaves. This heap needs to be mixed every week and it takes about 3 weeks for the conversion to take place. In the *Pit Method*, the same process as above in done but in pits specially constructed/dug out for this purpose. Mixing has to be done every 15 days and there is no fixed time by which the compost may be ready (depends on soil moisture, climate, level of organic material, etc.). The *Berkley Method* use a labour intensive technique and has precise requirements of the material to be composed. Easily biodegradable material, such as grass, vegetable matter, etc., is mixed with animal matter in the ratio of 2 : 1. This is piled and mixed at regular intervals. Compost is usually ready in 15 days.

(c) Vermi Composting :

Vermicomposting involves use of earthworms as natural and versatile bio-reactors for the process of conversion. Vermicomposting is done in specially designed pits where earthworm culture also needs to be done. As compared to above, this is a much

more precision-based option and requires overseeing of work by an expert. It is also a more expensive option (especially O & M costs are high). However, unlike the above two options, it is a completely odour less process making it a preferred solution in residential areas. It also has an extremely high rate of conversion and so quality of end product is very high with rich macro and micro nutrients. The end product also has the advantage that it can be dried and stored safely for longer period of time.

(2) Incineration :

Incineration is the process of controlled combustion at around 800°C for burning of wastes and residue, containing combustible material. The heat generated during this process can be recovered and utilised for production of steam and electricity. This method is usually used to achieve maximum volume reduction, especially where there is a shortage of landfill facilities. It is also usually a cost effective method of disposal. However, in Indian conditions, it is not always very successful due to the low calorific value of Indian wastes (low combustible material).

(3) Pelletisation :

This refers to creation of fuel pellets (also called refuse derived fuel or RDE) from MSW. Pelletisation generally involves segregation of incoming waste into low and high calorie material followed by separate shredding. Different heaps of shredded wastes are mixed together in suitable proportions and solidified to produce RDF pellets. Pellets are small cylindrical pieces with a calorific value of 400K cal/kg. Since this is quite close to calorific value of coal, it can be used as a substitute fuel. However, calorific value of the pellets completely depends on the calorific value of the waste stream which needs to be sorted in Indian conditions to allow only the right type of waste to come through.

(4) Pyrolysis/Gasification

In this process, combustible material is allowed to dry/dewater and is then subject to shredding. These are then incinerated in oxygen deficient environment (pyrolysis). Gas produced from this process can be stored and used as combustible source when required. However, quality of the gas also depends largely on quality of waste stream and requires high calorific value waste inputs. Different types of pyrolysis/gasification system are available which can be used depending on local conditions ; some of these include Garrets Flash Pyrolysis process, ERCB process, Destrugas Gasification process, Plasma Arc process, Slurry Carb process, etc. Recent studies for Indian scenario clearly show that while net power generation for thermo-chemical conversion processes is around 14.4 times the quantity of waste input (in kW), the same for bio-chemical conversion process is 11.5 times the waste inputs (provided 50% of waste inputs are volatile solids). However, in terms of environmental impact, the latter is far safer option than the previous.

(5) Bio-Methanation :

While bio-methanation is generally classified as a WTE process, unlike the previous three alternatives, which use thermo-chemical conversion, this uses bio-chemical conversion similar to composting process. It basically taps the methane gas generated from the bio-chemical reaction in wastes dumped in aerobic digesters.

(6) Landfill Gas Recovery :

Similar in principle to the bio-methanation option, this process taps and stores gas produced in sanitary landfills. Typically, landfill gas production starts within a few months after disposal of wastes and generally lasts till 10 years or more depending on composition of waste and availability/distribution of moisture.

The objective of SWM is to reduce the quantity of solid waste disposed off on land by recovery of materials and energy from solid waste in a cost effective and environment friendly manner.

However, this is a problem which Indian cities have been grappling with since long. According to the Central Pollution Control Board (CPCB), the average waste generated comes to about 490 grams per capita per day. Out of this, average collection ranges from 50% to 90% of the total solid waste generated, while 94% of the wastes are disposed of unscientifically. The typical rate of increase of waste generation in Indian cities has been estimated at around 1.3% annually. The expected generation of MSW in 2025 will therefore be around 700 grams per capita per day. Considering that the urban population of India is expected to grow to 45% of total (World Bank) from the prevailing 28% the magnitude of the problem is likely to grow to even larger proportions unless immediate steps are taken to control waste generation, ensure better collection and sustainable disposal.

COMPOSTING OF SOLID WASTE :

Composting is achieved by de-composting the organic solid waste either in the presence of oxygen (aerobic composting) or in the absence of oxygen (anaerobic composting). By far, about 35 composting projects have either emerged or are being finalised in different cities in the country. The installed capacity of these projects ranges from 80-700 tons per day. Funds required for such projects vary from Rs. 30 million to Rs. 75 million. Mostly, the compost plants have come up with private sector participation on different formats of privatisation.

A key risk associated with composting relates to the end product—compost that is free from environmental hazards. If composting is not based on segregation at source, the end product becomes generally contaminated. The quality also affects the marketability of the compost. If a higher degree of segregation is achieved, quality of compost is usually higher and less toxic. Effective source segregation, therefore, becomes an important pre-requisite for successful composting. However, the concept of source segregation has still to catch on in India. Although some cities have initiated the concept of source segregation following Hon'ble Supreme Court order, most of these cities lack the infrastructure, resources and technical expertise to make optimum utilisation of segregated wastes. The quality of segregation at source also is very poor due to lack of awareness and enforcement.

WASTE-TO-ENERGY PROJECTS

Waste-to-energy (WTE) projects for disposal of solid waste are a relatively new concept in India. Although these have been tried and tested in developed countries with positive results, these are yet to get off the ground in the country largely because of the fact that financial viability and sustainability is still on test. Many environmentalists argue that environmental costs incurred in these projects are far higher than the returns. While a number of cities have opted for WTE plants, like Hyderabad, Vijaywada, Lucknow, etc., most of the plants have failed to produce the desired results primarily due to the unfavourable composition of waste in India and lack of market for the end products. Although, recent WTE plants have involved the private sector in their installation and O&M, and are heavily dependent on subsidies provided by the Ministry of Non-Conventional Energy Sources (MNES) and financing institutions such as HUDCO. Policy makers now need to take a decision on sustainablility of WTE projects in India and clearly indicate the steps which need to be taken to ensure optimum output from WTE plants. The MNES has already taken a step in this direction by preparing a Master Plan on Waste-to-Energy for India, which is being finalised.

Urban local bodies are spending a very high percentage of their budget on cleaning and waste disposal. The increases in cost are exacerbated by poor vehicle routing, lack of proper infrastructure and inadequate maintenance. Increasing land prices and reduced availability of suitable disposal options in and around urban centres steadily make safe waste disposal more difficult and costly. Despite

many good practices from around the world being available, most ULBs in India select inappropriate technologies. There is a need to understand these good practices and identify local context which led to their success as well as identify major constraints faced during project preparation and implementation. Simultaneously, there is a need to identify and address the resource gap faced by ULBs for effective SWM.

CONCLUSION :

The problem of municipal solid waste management has acquired alarming dimensions especially over the last decade. In the earlier days waste management was hardly considered as an issue of concern as the waste could be easily disposed off in an environmentally safe manner within the generation premises. However, with time, due to changing lifestyles of people coupled with urbanization and industrialization, the characteristics of wastes have changed making it more difficult to manage.

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3. M. Dutta. and S. Mahendra, Waste Generation and Disposal on Land-waste Disposal in Engineered Landfills, Narosa Publishing House, New Delhi, 2001.
4. Accelerated Programme on Energy Recovery from Urban Wastes, Circular of Govermment of India, Ministry of Non-conventional Energy Sources, New Delhi, dated 25th July 2005.

DO YOU KNOW ?

Q7. What is a 'Jiffy' ?

Q8. What is the popular name of Polygraph ?

SOMETHING TO THINK ABOUT

WHAT IS THERE IN A SMILE ?

Hem Shanker Ray

Smiling is not a laughing matter, rather it is a subject that merits profound thinking and it offers much scope for research by psychologists, social scientists and others. A smile is not a precursor to laughter and, therefore, laughter is something else altogether. Imagine meeting a familiar somebody in the market place. You will perhaps flash a smile spontaneously. But you would not laugh at him, would you ? Actually, you can always smile at somebody, even perfect strangers, but laughing at anybody, even someone well known, may be asking for trouble.

Why do you smile ? One reason is that it is instinctive amongst humans. Babies endear us by their toothless grin within days of being born. The divine smile, incidentally identical everywhere in the world in all races, melts everybody and it induces others to come forward to protect the lovely creature against odds. Strangely, it is only the *Homo Sapiens* that smile. Other primates, monkeys with tails and apes without this appendage, do hoot, screetch, whimber, chuckle, roor and make other kinds of sounds alongside various facial expressions, but they do not smile. Many occasionally widen their mouths showing teeth and gum but one should not think that that is a smile. In the primate kingdom this is usually an expression of surrender to one placed higher in the pecking order. This also implies that if you are facing a monkey it will be serious mistake to act friendly and smile at her, specially him, This is a mistake many well meaning tourists commit in temples and other places infested with monkeys. By smiling you indicate surrender and, therefore, your gesture is practically an invitation to the monkey to pounce on you, snatch whatever you are carrying and even search your pockets. You should not stare at them either, because to them it indicates challenge (you know that boxers are trained to stare at the opponents before the bout to intimidate them). A star may instill fear in some who will run away but some others may well accept your challenge. You can best ensure peaceful coexistence by simply looking away and keep walking, preferably so as to distance yourself.

Since we are not monkeys, we can safely smile at each other and social bonding requires this. There are, of course, many kinds of smiles. Dancers often paste a smile on their faces on stage unless they are depicting through *abhinaya* some specific moods not suited for smiling. The celebrities must always smile when they face the cameras. It becomes so much of a routine that once the widow of a famous U.S. congressman, who had been assassinated minutes earlier, flashed a smile when cameras focussed on her. There was, of course, much sadness in the smile.

A smile does not necessarily medicate inner joy. Common men and women, of course, smile a lot often spontaneously and sometimes in a

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calculated manner. In a smile one can find one or more of the following—kindness, appeal for help, submission, a condescending attitude, derision, flattery, pride of authority or power, mischief or croockedness, threat, ecstacy, etc. A smile therefore, can have devastating effect on the onlooker who may swon in love, feel blessed in devotion, feel humiliation and anger or simply feel acceptance of familiarity or appreciation. Blessed is the person who knows how to smile and when.

Most of the time, however, a smile denotes some shade of happiness and invites a matching response. It does not imply the same thing in different societies though and can, therefore, be misunderstood. Many Indians going abroad for the first time are intrigued that perfect strangers such as hostesses, waitors or waitresses, sales persons flash warm smiles so very frequently—something not done in India. Some immature persons are offended by this and some so charmed that they take it as an invitation for familiarity or, who knows, something beyond that too.

Children and adolescents smile and laugh a lot but adults do not. The grumpy babus of government administration apparently have so little to be cheerful about that they seldom smile. They do not like others to smile either. On the other hand, many progressive institutions consider smiling to be a useful investment and even train telephone operators to smile when they take a call. As a caller one can actually feel the smile from the voice because a smile adds a special flavour.

Now let us discuss why some smiles become special—what makes the smile of Madhuri Dixit or Renuka Sahani so bewitching or why Mona Lisa's smile remains unscrutable According to a recent report (*sec* Times of India Nov. 27, 2007, p. 15) one can try to understand the elements of a perfect smile. Of course, an uniform array of white teeth gives a good start but that is not all ; there are other factors that relate to the rest of the face, specially the eyes. If somebody is all covered except for the mouth then his or her smile will convey little.

As regards the main ingredient of a good smile, the teeth must have the right colour, size, width and shape. Ideally the width of a tooth should be 80 percent of the height for the central teeth. Other teeth arranged laterily should be 62 percent smaller. The whitewash of the teeth should not be more than that of the eyes to ensure that the smile does not distract the viewer too much from the rest of the face. This implies that if you close your eyes while smiling then you make a poor impression. Also, that nobody should bleach the teeth to be too white. Yellow and stained teeth are not welcome even if they match the eyes.

The ideal width of a smile should be at least half the width of the face. The wide mouthed Julia Roberts thus has a winning smile. Those who have small mouths need not excercise restraint while smiling. Covering the mouth with hands, of course ruins a smile. Those with bad teeth are advised to keep the lips together. Although wide smiles are often more appealing, ear to ear smiles may be scary. Symmetrical lips add to the beauty of a smile but gums do not. The top row of teeth plays the main role and, therefore, the bottom row may be left out for laughter only. What the onlooker likes to see is clear white teeth in a splendid array of diminishing size with at best a thin line of pink gum. There can be interesting exceptions though e.g. one oddly placed tooth that creates a distinctive style. It has to be one and one only and not thirty two. A steel brace on the teeth would surely have a negative impact.

What about Mona Lisa's smile which has encouraged innumerable theories ? Some even suggested that she may have been hiding some secret such as pregnancy. No teeth are seen and the lips are only slightly moved. Obviously one needs to examine the rest of her, specially the face.

There are scientists who have spent their lifetimes studying human expressions which appear to be almost universal. They have prepared facial action coding system (FACS) for all kinds of emotions and computerised the data.

This is not simple matter because the human face has 43 distinct muscular movements and using only two at a time the face can produce 300 expressions. Using 3 movements at a time can generate 300 expressions and obviously, there can be thousands of alters if there is in the combination of more muscles of course, many such expression would only produce 'funny faces' with no particular meaning but, at the same time, countless other expressions do convey definite feelings. A computer analysis reported (*The Telegraph*, Dec. 15, 2005) said that Mona Lisa's smile is a mixture of the following : Happiness–83 percent, Disgust–6 percent, Fear–9 percent and Anger–2 percent. The creator Leonardo da vinci may not have known that.

One should know that there is a mind-body connection i.e. a healthy body and a happy mind create a charming smile. If there are sinister thoughts or if there are physical ailments, these show up in the smile also. Conversely, if one smiles and laughs a lot, then these have a positive, even curative effect, on the body–thanks to release of happiness chemicals in the body system. So, try to smile more and see the happiness growing within, after a while you do not have to try at all.

You can smile at yourself in the mirror and make measurements with a scale to evaluate your smile in terms of the physical parameters. If you do not score very high then rest assured that you are in the majority. Perfect or even high scoring smiles are rare. Any smile, however is better than no smile and that means do keep smiling !

KNOW THY INSTITUTIONS

UNIVERSITY OF KERALA

The vision of a modern university for promoting education, specifically technical education, in the erstwhile princely state of Travancore led to the establishment of the University of Travancore through a royal proclamation in 1937. The vision is epitomised in the motto *Karmani Vyagyate Prajna*—Knowledge realising itself in action—adapted from Panchatantra. It became the sixteenth University in India to be established in the prevailling model of western Universities. For a long time, and for a considerable period after it became the University of Kerala in the post independence India, the University was rated as one of the best of its kind in the whole world. May be it is difficult at present to have a proper perspective of the time and the magnificence of the institution, but a historical perspective can be generated if it is remembered that Trivandrum happens to figure among the first three places in India to which Jamshedji Tata began his air service, and the year 1935 saw the ruler of Travancore, Shree Chithira Thirunal Balarama Varma, flying out of the airport at Trivandrum. Incidentally, several major engineering departments including the Public Health Engineering, and the Water Works were under the direct supervision of the University. The Observatory Hills which houses one of the earliest modern observatories in India is where the Wellington Water Works, one of the marvales not only of its time but even today, is

situated. The University exemplifies the great tradition of popular education of singular excellence in Travancore.

Presently the University of Kerala is one among several Universities in the state of Kerala and has its territorial jurisdiction in the southern districts of the state. The administrative offices and a few departments are located at the Senate House campus at the city centre while the major set of the teaching and research departments are situated at the Campus at Kariavattom which is 12 kilometers from the city centre. While the Senate house building is an architectural splendour which has become a landmark of the city, the Kariavattom Campus is almost a rustic retreat with its bewitching greenery. It is fast developing into a modern university campus with all atendant faclities and houses the university centres devoted to advanced and fronter disciplines. The Technopark is also adjacent to the Campus. The Kariavattom campus is spread over 450 acres on either side of the national highway. Airport and the railway station are less than 15 Kms away. There are over 2500 students and research scholars and nearly 250 faculty members in 41 P. G. departments of study and research and 20 Centres of study. There are also quarters for faculty and hostels for resident students along with other civic amenities.

At present, the University has 16 faculties. There are 188 affiliated colleges comprising of 63 arts and science Colleges, 18 Engineering Colleges, 5 Medical Colleges, 4 Ayurveda Colleges, 2 Homoeopathy Colleges, one Siddha Medical College, 5 Dental Colleges, 5 Pharmacy Colleges, 19 Nursing Colleges, 2 Law Colleges, 48 Teachers Training Colleges and one Physical Education College. Besides, there are 4 affiliated institutions conducting two year full time MBA programmes, 4 Colleges offering MCA, 3 Unaided Hotel Management Catering Technology Colleges and one Para Medical College. In addition, 2 Engineering Colleges offer MBA programme and 3 Engineering Colleges offer MCA. The University has also got an Engineering College of its own in the Campus offering B. Tech programmes in Information Technology, Computer Science, Electronics and Communication.

The Unviersity Departments offer a wide range of teaching and research at post graduate, M. Phil and Ph. D. levels. The courses in the departments are conducted in the credit and semester system, while the post graduate courses in affiliated colleges follow the semester pattern. At present, about 32 colleges offer post graduate teaching programmes. Some of the affiliated colleges offer M. Phil Courses and some have been recognized as research centers. The University has also recognized a number of other institutions as research centres. All these institutions conform to the aims and objectives of the University and its programme of teaching and research.

The Academic Staff College of the University of Kerala, set up with UGC aid, has done the University proud by being adjudged first among all ASCs in India consecutively for several years. The University has also widened its horizons by entering into academic cooperation with foreign universities like Valladolid of Spain and Claremont of the United States of America. UGC has identified the University as one of the 26 institutions selected for promotion of India studies by foreign students.

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LIFE SKETCHES OF OFFICE BEARERS AND SECTIONAL PRESIDENTS INDIAN SCIENCE CONGRESS ASSOCIATION, 2009-2010

DR. G MADHAVAN NAIR

General President

G. Madhavan Nair was born on October 31, 1943 in Thiruvananthapuram, Kerala. He graduated in Engineering from Kerala University in 1966 and underwent training at Bhabha Atomic Research Center (BARC), Bombay. He joined Thumba Equatorial Rocket Launching Station (TERLS) in 1967. Since then, he has held various positions posting illustrious milestones on his way to the position of Chairman ISRO.

During his tenure of six years as Chairman, ISRO/Secretary, DOS, 25 successful missions were accomplished i.e., INSAT-3E, RESOURCESAT-1, EDUSAT, CARTOSAT-1, HAMSAT-1, INSAT-4A, PSLV-C5, GSLV-F1, PSLV-C6, CARTOSAT-2, INSAT-4B, SRE-1, PSLV-C7, PSLV-C8, GSLV-F04, INSAT-4CR, PSLV-C10, CARTOSAT-2A, IMS-1, PSLV-C9, CHANDRAYAAN-1, PSLV-C11, PSLV-12, PSLV-C14 and OCEANSAT-2.

He has taken initiatives towards development of futuristic technologies to enhance the space systems capabilities as well as to reduce the cost of access to space. He has given major thrust for evolving application programmes such as tele-education and telemedicine for meeting the needs of society at large. As on today, more than 31,000 classrooms have been connected under the EDUSAT network and telemedicine is extended to 315 hospitals–269 in remote/rural/district hospitals including 10 mobile units and 46 super speciality hospitals.

He has initiated schemes for Village Resource Centres through satellite connectivity which aims at improving the quality of life of the poor people in the villages. More than 430 VRCs are facilitating access to spatial information on important aspects like land use/land cover, soil and ground water prospects and enable the farmers in taking important decisions based on their query. VRCs also enable online interaction between the local farmers and agricultural scientists. It also provides information of many govenmental schemes, farming system, action plans based on weather, community specific advice on soil and water conservation, etc.

In his tenure as the Director of the Liquid Propulsion Systems Centre from 1995-99, India's efforts towards indigenous development of cryogenic technology took concrete shape and vital infrastructures were built and critical technologies were developed.

In his role as the Director of VSSC from 1999 till he took over the present position, Dr. G. Madhavan Nair led VSSC, the largest Centre of ISRO with about six thousand employees working in various engineering and scientific disciplines towards the development of India's Geo-synchronous Satellite Launch Vehicle-GSLV capable of orbiting 2000 kg class of satellite into Geo Transfer Orbit, which had its successful flight in the very first attmept, and declared operational

after its successful flight in 2003. He was also responsible for charting the road map for future development of ISRO's activities, especially in the launch vehicle area targeting low cost access to space.

Dr. G. Madhavan Nair as Chairman, Space Commission is responsible for chalking out the future plan for space research in the country. Major thrust are in scientific exploration of outer space using the ASTROSAT and Chandrayan (moon) missions apart from implementing schemes for telemedicine, tele-education and disaster management support systems.

He is also providing guidance and leadership in undertaking new technology developments related to launch vehicle, spacecrafts for communication, remote sensing and applications programmes to meet societal needs.

In the international arena, Dr. Madhavan Nair has led the Indian delegations for bilateral cooperation and negotiations with many Space Agencies and Countries, specially with France, Russia, Brazil, Israel, etc., and has been instrumental in working out mutually beneficial international cooperative agreements. Dr. G. Madhavan Nair has led the Indian delegation to the S & T Sub-Committee of United Nations Committee on Peaceful Uses of Outer Space (UN-COPUOS) since 1998. Dr. G. Madhavan Nair's focus has always been to achieve self-reliance in the high technology areas and to bring the benefits of space technology to the national development, specially targeting the needs of the rural and poor sections of the society.

Dr. Nair is Fellow of different academies including Indian National Academy of Engineering, Astronautical Society of India, National Academy of Sciences, and Chairman, Research Council of National Aerospace Laboratories. He has been conferred with D. Philosophy (*Honoris Causa*) and D. Sc (*Honoris Causa*) by various universities. Dr. Nair is also President, Astronautical Society of India (ASI), Aeronautical Society of India (AeSI), and Vice-President, Scientific Activities Committee of IAA.

Some of the awards received by him includes MP Birla Memorial Award 2009, Bhu Ratna, AV Rama Rao Technology Award, Chanakya Award in the area of Technology Innovative Leadership, Vikram Sarabhai Memorial Gold Medal of ISCA, Padma Bhushan in 1998 and Padma Vibhushan in 2009.

DR. ASHOK K. SAXENA

General Secretary (Outstation)

Dr. Ashok K Saxena obtained his Masters degree in Zoology in First Division and 3rd position from Meerut University, Meerut in 1967. Dr. Saxena obtained his Ph. D. degree from Kanpur University, Kanpur in 1973. Dr. Saxena has more than 42 years teaching experience of Post Graduates and Degree classes. He first joined as a Lecturer in the Deptt. of Zoology, DAV College Kanpur UP., in 1967 and became Reader in 1986 and served as a Principal, DAV, College Kanpur from 2005 to 2009. Dr. Saxena also served as a Convener of the Board of Studies in Zoology of CSJM, University, Kanpur. He retired as a Dean Faculty of Science, CSJM, University, Kanpur in October 2009.

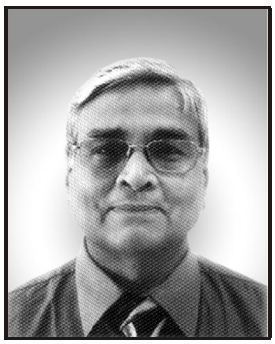
Dr. Saxena has 40 years of research experience and under his research guidance 23 students have been awarded Ph. D. degrees. He has got published more than 55 research papers in National and International Journals. Dr. Saxena has more than 21 publications in the form of Books, Symposia Proceedings. He is Convener of the Editorial Board of "Trends in Life Sciences" an International Journal, Member Editorial Board "Life Science Advances" an International Journal and Referee of ICAR Krishi Bhavan, New Delhi.

Dr. Saxena has received several honours/awards in recognition of his meritorious research works. Some of which are : 1. International Award of Recognition 5000 Personalities of the World for outstanding services to the Research and Teaching Profession by American Biographical Institute, 2. Zoological Soceity of India Gold Medal for the contribution of Life Sciences. 3. Research Fellow of American Biographical Institute 4. One of the Member of the Research Board of Advisors of American Biographical Institute.

Dr. Saxena is also Life member of different Academies/Societies like Zoological Society of India, BHU, Varanasi, Indian National Academy Sciences, Allahabad, Society of Biosciences, Muzaffarnagar, Indian Society of Life Sciences, Kanpur, Indian Science Congress Association, Kolkata, etc.

Dr. Saxena has been associated with a number of Professional Societies including Founder General Secretary Indian Society of Life Sciences. He has been associated with the Indian Science Congress Association from the last 35 years and was first elected as a Member of Sectional Committee of the Section of Zoology, Entomology and Fisheries of ISCA. He was also elected as a Recorder of the Section of Zoology, Entomology and Fisheries for two years i.e. 1993–1994 and 1994–1995. Later he was elected as a Council member in 2004–2005 and 2005–2006 and then elected as a Member of Executive Committee of ISCA in 2006–2007. In 2007 Dr. Saxena was elected as a General Secretary (Outstation) of Indian Science Congress Association for the period of three years i.e. 2010.

Recently, Dr. Saxena was invited by the American Association of Advancement of Sciences at their 80th Annual Meeting held in Feb 2008 at Boise State University Boston, USA. In 2009 Dr. Saxena was also invited by the Sungkyunkwan University, Suwan, South Korea, to deliver lectures.



PROF. B. P. CHATTERJEE

Treasurer

Received Ph. D. on "Structural Elucidation of Pneumococcus type XXII Polysaccharide" from the University of Calcutta in 1973. Studied lectin-carbohydrate interactions in Gerhard Uhlenbruk's laboratory in Medical University and Clinic, Cologne, Germany (1976–1978). In 1990, Professor of Biological Chemistry, Indian Association for the Cultivation of Science, Calcutta, Chairman

(1997–2000), and Senior Professor (2006-2007). During 30 years, he developed a lectin school that produced 18 Ph. D.s in the field of lectin-carbohydrate interaction which culminated to initiate research on glycobiology.

He received many awards including Life-time Achievement Award from Association of Carbohydrate Chemists and Technologists (India) and Life-time Achievement Education Award from Health Education Development Association, New Delhi, As DAAD Fellow he visited Max-Planck Institute for immunobiology, Friburg, Medical University and Clinic, Cologne and Biochemisches Institute, University of Keil in 1984. He visited Borstel Research Institute, Borstel, Germany in 1987. As as Senior JSPS Fellow he visited Department of Biological Chemistry, Faculty of Pharmaceutical Sciences, Kyoto University, Japan (2004), visited Institute of Molecular Science, Okanzaki, Japan and established a long-term collaboration with IMS. Recently he was awarded Distinguished Professorship in North-East by the Department of Science & Technology, New Delhi. He was elected General Secretary, Indian Science Congress Association (2003–2006), participated in the British Association of Science Festival in University of Glasgow (2001) and University of Salford, Greater Manchester (2003) as a delegate of Indian Science Congress Association. He participated in several International Congress in the country and abroad. Following retirement from Indian Association for the Cultivation of Science, March 2007, he was given the chair of Emeritus Professorship in West Bengal University of Technology, Kolkata and is currently engaged in developing school of Glycobiotechnology. He has been appointed the advisor of West Bengal University of Technology and received Emeritus Fellowship from All India Council of Technical Education, New Delhi.

DR. D. D. PATRA

President
Section of Agriculture and Forestry Sciences

Born in 1955 at Bankura, West Bengal, Dharani Dhar Patra had his School education from Dubrajpur Uttarayan, and graduation and post graduation from BCKV in 1967 and 1987, respectively. Dr. Patra did his Ph. D. in 1982 from Indian Agricultural Research Institute, New Delhi. His doctoral research fetched him the prestigious FAI (New Delhi) Gold Medal in 1983. His research interests are nitrogen balance in soil plant system, soil microbial biomass and nutrient bioavailability, utilization of marginal lands through cultivation of medicinal and aromatic crops and agro-technology of high value industrial crops, medicinal and based agroforestry system, bioamelioration of salt affected soils and heavy metal polluted soils.

Dr. Patra started his career as Assistant Professor in Soil Science and Agricultural Chemistry, in Rajasthan Agricultural University in 1982 and subsequently joined Central Institute of Medicinal and Aromatic Plants, (CSIR), Lucknow in 1987. He has been presently working as Scientist-G (Sr. Dy Director) and Head–Agro-technology Division. His significant contribution have been development of dual ^{15}N leveling technique for precise estimation of di-nitrogen fixation in cereal legume mixed cropping system, concurrent transfer

of fixed N to cereal, development of natural essential oil byproduct coated slow release urea fertilizer and technology for growing medicinal and aromatic crops in Usar land and other marginal lands. In recognition of his work Dr. Patra has been conferred with several awards and laurels ; the important among them are FAI Silver Jubilee Awards–1980, FAI Gold Medal–1983, PPIC–FAI Gold Medal–2000, 12th International Congress Commemoration Award–2005, UP Eminent Scientist Award on Natural Resource Managment–2006, ISCA Platinum Jubilee Awards, 2008 and member of the teams conferred with Golden Peacock Eco-Innovation Award, 2008 and CSIR Rural Development Award, 2008. Dr. Patra is a Fellow of the Indian Society of Soil Science, New Delhi, National Academy of Sciences, Allahabad and National Academy of Agricultural Sciences, New Delhi. Under Commonwealth Fellowship Dr. Patra visited Rothamsted Experimental Station, U.K. in 1983-84 and worked with Sir David Jenkinson and under STA-JISTEC Fellowship visited Hokkido National Agricultural Experimental Station, Japan in 1999. Besides this, Dr. Patra delivered lectures in different parts of the world.

Besides JMAPS, Dr Patra is an honorary Reviewer of several national and international journals viz J. Indian Society of Soil Science, Indian J. Agric. Sci., Natural Product Radiance, Bioresource Technology, Plant and Soil, Biology and Fertility of Soil, Atca Horticulturea, Soil Biology & Biochem. Soil Ecology, Archives of Soil Science & Plant Nutrition, Pedology etc. Dr. Patra is a member of the Research Council of Herbal Drug Research Institute, Dehradun. Dr. Patra has to his credit more than 120 research papers, 20 Farm Bulletins 15 Review-cum-Chapter in Books, 2 edited Books and 6 US patents Dr. Patra has guided five M. Sc. and seven Ph. D. students for their thesis work.

PROF. G. K. KULKARNI

President
Section of Animal, Veterinary and Fishery Sciences

G. K. Kulkarni has completed his High School Education from Zilla Parishad High School, Udgir (Maharashtra) in 1968, and college graduation from Maharashtra Udayagiri Mahavidyalaya, Udgir in 1972. He had obtained Post-Graduate (Master of Science) degree in Zoology in First Division in 1974 and Doctoral (Ph. D.) degree in 1977 from the Post-Graduate Depertment of Zoology, Dr. Babasaheb Amdedkar Marathwada Unviersity, Aurangabad. He joined the Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University in 1980 as a Lecturer. He is serving the academic cause of this Department of Zoology till today i.e. for the last 34 years under different capacity as a Researcher, Lecturer, Reader and Professor, and Head of the Department from 2004 to 2006 under rotation pattern.

He has achieved several recognitions in his academic and professional career as a distinguished educationist. He is the recipient of Eminent Indian Zoologist Gold Medal, Ideal Teacher Award, Prof. J.S. Datta Munshi Gold Medals. Currently he is the Vice-President of Zoological Society of India.

He is a recognized Research Guide in Zoology, Environmental Science and Interdisciplinary

Science. 25 students got Ph. D. degree under his supervision till todate. He had over 136 publications in journals of national and international repute. He is a Life Member of more than 10 various national level Research Societies . He is a Member on Editorial Advisory Board of at least dozen national level research journals. He is a Member of Screening Committee of Agriculture Scientist Recruitment Board (ASRB) of Indian Council of Agricultural Research (ICAR), New Delhi. He has edited 3 research reference books published by A.P.H. Publ. New Delhi During 2006-07.

He has completed his Post-Doctoral Work in various Institutions in India and Abroad : He was a Post-Doctoral Fellow at Tulane University, New Orleans, USA Visiting Scientist at University of Southern California, Los Angeles, USA and at Marine Research Laboratory of Duke University, Beaufort, N.C. USA Post-Doctoral Fellow at Department of Ecology, Evolution and Organismal Biology, Tulane University, New Orleans, USA

He had pioneered the work on induced gonad maturation and spawning by using pharmacological agents like 5-hydroxytryptamine, dopamine etc in crabs, prawns and crayfishes to boost their aquaculture potential. A step towards ensuring food security for rural livelihood. He is also credited to work out in detail the neuroendocrine mechanisms in controlling various physiological activities in annelids (leeches and earthworms) and crustaceans. His research achievements were recognized by the Scientific Society of North America by bestowing upon him its life membership i.e. Sigma χ_i.

He had travelld extensively throughout India and abroad in pursuit of research activities. He had undertaken a number of administrative responsibilities like Director, Central Assessment Programme ; Head of the Department ; Coordinator of DST-FIST Programme, Principal Investigator of at least 8 Major Research Projects, etc.

DR. AVNEESH SINGH

President
Section of Anthropological and Behavioural Sciences (including Archaeology and Psychology & Educational Sciences and Military Sciences)

Avneesh Singh, Director, Regional Labour Institute, DGFASLI, Min. of Labour & Employment, Govt. of India, was born on July 22, 1960 at Aligarh. Perusing his education, he passed M.Sc. (Industrial Psychology) from G.K University, Hardwar. He carried out research work at Indian Institute of Technology, (IIT), Delhi, in the area of 'Mental Health of Industrial Workers' and was awarded Ph. D. in the year 1989. In India and abroad, Dr. Singh received specialised training in the areas of Organisational Behaviour and Behavioural Aspects of Occupational Safety and Health.

After serving for four years as Research Officer at Dept. of Psych., Safdarjang Hospital, New Delhi, Dr. Singh in the year 1991 joined Min. of Labour & Employment, Govt. of India as Dy. Director at Central Labour Institute, DGFASLI, Mumbai, There he conducted many research

projects in the field of Behavioural Aspects of Occupational Safety and Health, pertaining to Factories Act (1948). Some of the notable research studies are-Occupational Stress in Newspaper Industry ; Improvement of Working Conditions and Productivity in Small Scale Enterprises (an UNDP Project) ; Structure & Functions of Safety Committees in Docks–A National Study ; Implementation of Factories Act–A National Study; Assessment of Capabilities and Management Occupational Safety and Health in the State of Delhi ; Occupational Stress among Safety Officials working in the MAH Installations–A National Study.

He has provided guidence to a large number of students pursuing for M.B.A. and Ph.D. at different institutions, universities and organizations. To his credit he has more than 40 research papers and articles published in national and international journals and periodicals, and also three books. In addition to other professional and scientific bodies, Dr. Singh has held the office of the Recorder in the Section of Psychology and Educational Sciences, Indian Science Congress Association, Kolkata, during the years 2001 and 2002.

Dr. Singh developed a large number of training modules and training manuals in the areas of Occupational stress Management, Occupational Safety and Health for managers, supervisors, welfare officers, safety officers, and medical officers working for different industrial establishments.

Dr. Singh also worked as Officer-In-Cahrge (Western Region) at Protector of Emigrants, Min. of Labour, Govt. of India, Mumbai.

Presently, as Director-in-Charge at Regional Labour Institute, Faridabad, Dr. Singh has been entrusted the work of establishing the institute which is being developed as National Centre of Excellence in the field of Occupational Safety and Health to cater the needs of defferent northern States.

DR. J. S. YADAV

President
Section of Chemical Sciences

Jhillu Singh Yadav, Director, Indian Institute of Chemical Technology (IICT), Hyderabad has obtained his masters in 1972 and Doctorate in 1976 from India. He was a Post doc at Rice University, Houston & University of Wisconsin, Madison USA. In 1981, he returned to India and joined National Chemical Laboratory (NCL) Pune and subsequently in 1986 he moved to IICT, Hyderabad. In 1989, he was elevated as Head of the Department of Organic Division I and in October, 2003 he has been appointed as the Director.

In a span of 34 years of research career Dr. Yadav has been able to carry out extensive basic and applied research investigations in the synthesis of over 50 complex natural products of Biological relevance. Dr. Yadav is specialized in the state of art Asymmetric Synthesis to create

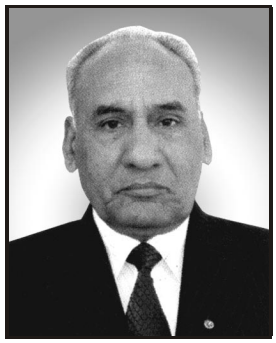
new Chiral centers and he extensively utilized them very effectively in the synthesis of complex organic molecules having self-defensive properties against rice-blast disease, hypersensitive metabolites and antifungal agents in a highly innovative manner. He excelled in creating and generating diverse chemical entities relevant to both agro and drug industry.

Dr. Yadav has successfully developed cost effective technologies for specially chemicals like Diltiazem, Ondasetron, Pyrazinamide, Ketotifen, Mefloquin, Tamoxifin etc., The global majors like SmithKline Beecham (SB), Dupont, FMC and Ranbaxy, Lupin and Dabur have entered into medium term contract research agreements with Dr. Yadav.

Dr. Yadav's impeccable instinct made him to foresee the versatility of Insect sex pheromones in Indian agro-system. He has pioneered the alternative eco-friendly and environmentally safe pest control technologies in India through the application of Insect pheromones as major tools in Integrated Pest Management (IPM) for better and cleaner agro-products. The Pheromone application technologies include the control of pests on Cotton, Rice, Groundnut and other Vegetable crops and they are highly applaudable.

More than Hundred students have received their Ph. D degrees under his able guidance. To his credit, he has 132 patents, more than 765 scientific publications and over 9500 citations.

Dr. Yadav is a fellow of Indian National Science Academy (INSA), Fellow of National Academy of Science (FNA), Fellow of Indian Institute of Chemical Engineers and has received numerous National awards which include the prestigious S. S. Bhatnagar Prize, Vigyan Gaurav Samman Award, Vigyan Ratna Samman, Goyal Award, Ranbaxy, Vasvik Award etc. He is also a Fellow of the Third World Academy of Sciences.



PROF. H. S. SHARMA

President

Section of Earth System Sciences

H. S. Sharma was born on 5th January, 1945 in a remote village Aliyabad in Newai Tehsil of Tonk District, Rajasthan. After graduation from the University of Rajasthan in 1964, he did Post graduation in Geography in 1966 and Ph. D. in 1970 from Saugar University, Sagar (M. P.).

Prof. Sharma joined the department of Geography, University of Rajasthan, Jaipur as an Assistant Professor in July, 1969 and elevated as Associated Professor and Professor in 1985 and 1996 respectively. He is first recipient of Career Award at the University of Rajasthan, Jaipur and also recipent of ISHEER Award Vijai Shri Award of International Friendship Society. New Delhi, Shiksha Vidhusan Award and Rajasthan Gorav Award.

Professor Sharma has been a visiting lecturer at JNU, New Delhi, visiting fellow at Salford and East Anglia, U. K. under the scheme of Alis Link Programme visiting Professor at Punjab University, Chandigarh and Mizoram University, Aizwal. Professor Sharma delivered extension lecturers, attended seminars, conferences and delivered Keynote Addresses in India and abroad.

The research interests of Professor Sharma include geomorphology, arid resources, soil erosion, desertification, environmental hazards and landuse changes. He has nearly 17 books to his credit on different themes of geography. Apart from this, he is a author of about 80 research papers published in journals of national and international repute including Nature (1973) and Journal of Geomorphology (1989). He has supervised nearly 4 dozen Ph. D. thesises. He has also completed nearly 8 major research projects sponsored by UGC, DST, Ministry of Environment and Forest, DRDO, SAC and Noragric.

During his university service, Professor Sharma acted as Dean, faculty of Science, Member Syndicate, HOD Depatment of Geogrphy, Director, Indira Gandhi Centre for Environmental Studies, Director DGC, Academic Staff College, University of Rajasthan, Jaipur.

Professor Sharma is the life member of a number of different academic and Professional bodies of India and abroad. He also served as President of Indian Institute of Geomorphologists (2001), Indian Institute of Geographers (2005), National Association of Geogrphers, India (NAGI, 2006-07) and Indian Human Ecology Council.

DR. G. S. MUKHERJEE

President
Section of Engineering Sciences

G. S. Mukherjee earned B. Sc. (Hons) from Calcutta University and obtained B. Tech and M. Tech. degrees from the same University with a subject background of chemical engineering and specialization in polymer technology. He did his Ph.D in Polymer Science & Technology from Calcutta University and joined as Research Scientist in Defence Research & Development Organization, DMSRDE, Kanpur in 1985.

He has more than 25 years of experience in active R & D work on Polymer Engineering Science while contributing towards development of products based on toughened resins, syntactic foam, Kevlar reinforced ballistic composites, sandwich structures for attenuation of blast, extrudable optically transparent polymer materials for windshield structure for light combat aircraft, for which he received DRDO cash award. He also contributed in the academic research areas of photopolymerization, kinetic parameters, thermodynamic compatibility, blends, IPN, polymer additives and modifications of resins, NLO materials and magnetic nanocomposites. Besides active research, he took additional responsibility of Headship of Technical Co-ordination & HRD of DMSRDE, Kanpur (2005-06). Currently he is

Scientist-F and Jt. Director and is deputed to prestigious G-FAST, New Delhi.

Besides product development work, he authored and coauthored about a hundred research papers in Journals, proceedings and technical reports. He is peer reviewer of research papers for about a dozen of different Journals.

He was a member of peer review committes of various projects and was member of technology councils of a few DRDO labs besides reviewer of project proposals received from universities and institutes. He is a recognised PhD guide of Kanpur (CSJM) as well as Indore University (DAVV) and guiding three PhD students. His current research interest is primarily in nanocomposites and energy materials. He has research interaction with institutes like UGCDAE-CSR ; Centre for Advanced Technology, Indore, Delhi College of Engineering. Presently, he is associated with the program of solar energy and energy efficient power systems. He delivered quite a few invited lectures in different events at university and institutes.

He was a DRDO delegate, Govt. of India under India-Singapore research cooperation to visit different universities and Institutes of Singapore. He was also a delegate, Govt. of India to visit R & D Institutes and DuPont of USA under Indo-US Science & Technology Cooperation on power and energy.

Dr. Mukherjee obtained India National Science Academy (INSA) visiting Fellowship. He is a Fellow of Institution of Chemists (FIC) as well as a Fellow of Institution of Engineers (FIE). He was Associate Editor of the *J. Ind. Chem. Soc.* (Chem. Engg.) besides a member of publication committee. Currently he is a Council Member of Indian Chemical Society. He got membership of international order of merit, Cambridge. He was executive member, subsequently became Recorder of Ind. Sci. Cong. (Engg Sci. 2006-2008). He is in the Editorial Board of the Journal *Indian Science Cruiser*. He is a life member of many scientific bodies and received invitations for membership of National Geogrphic Society, New York Academy of Sciences and American Association for the Advancement of Science.

PROF. S. P. GAUTAM

President
Section of Environmental Sciences

S. P. Gautam, was born on 15th November, 1956 in Jabalpur, M. P. He passed Higher Secondary School Certificate Examination, MP in 1972. He B. Sc. in 1975 passed and M. Sc. in Botany with specialization in Microbiology in 1977 in First Division from Jabalpur university and earned Ph. D. in January 1982 on "Role of Pectolytic & Cellulolytic enzymes in pathogenesis with special reference to fruit root disease of citrus caused by *Thielaviopsis paradoxa*".

He started his carrier as Asstt. Professor in Botany in M. P. Govt. Educational Service and in 1985 he was awarded National Post doctoral Research Fellowship by Ministry of HRD. Govt. of India to persue research in USA, where he worked in the labs of Prof. J. E. Hopper, Prof. J. J. Deploey, Penn State University and collaborated with Dr. Jean F. P. Hamel, Deptt. Of Chemical Engineering, Cambridge. As Biotechnology Overseas Associate Prof. Gautam worked in the University of Massachusetts. USA. He also worked

in Hershey Medical Centre, Penn. State University and Deptt. of Molecular Biology Millersvill University. He exhaustively travelled the world for learning the pollution abatement system mechanisms/technology.

In 1987, Dr. Gautam worked as CSIR Pool Officer, joined as Reader in January, 1988 in the Department of Biologial Sciences, R. D. University, Jabalpur and in 1996, was selected as Prof. of Biotechnology in the same University. He was appointed Rector of the R. D. University in 1999. In the year 2003, Prof. Gautam was nominated as Dean Facutly of Life Sciences and consequenctly was appointed as Vice-Chancellor of the R. D. University, Jabalpur, M. P. by Chancellor & Governor of M. P.

Prof. Gautam headed the M. P. Pollution Control Board as Chairman for two years from 1st Feb. 2007 to 31st January, 2009. He joined the post of Chairman, Central Pollution Control Board on 2nd Feb. 2009, Ministry of Environment & Forests, Govt. of India, Delhi.

Prof. Gautam contributed variedly in training programmes, Seminars and Symposia. He supervised 32 Ph. D. students and published about 60 original research papers and also edited two books. Several International patents rest in his credit. He contributed very significantly in the environmental field, such as : Microbial decolorization of diazonium compounds empolying yeasts, bioremediation of effluents of Gelatin factories, developed microbial consortia of mycorrhiza and bacteria for amelioration of denuded lands, rehabilitation of coal mines over dumps, afforestation of tailing dams, energy harnessing through co-processing of high colorific industrial wastes, encouraged waste heat recovery in cement plants and plastics garbage, co-processing of cement kilns.

DR. (MRS.) S. V. INGALE

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

Shraddha Ingale hails from Ahmednagar, currently associated with the New Arts, Science and Commerce College as a lecturer in P. G. Department of Mathematics. She holds a doctorate in *"Fuzzy Topology"* and is actively involved in research activities, industrial and academic, relating to Fuzzy mathematics.

She graduated from Bhavan's College, Ahmedabad as a Gold Medalist, completed her post-graduation studies from Gujarat University and doctoral studies from Pune University. Along with her degrees in the Mathematics fields, she also holds a Diploma in Software Management.

She started her professional life with a brief stint in the IT department of *Milton Plastics* as a *Database Administrator* for a year. She has been associated with the New Arts Science and Commerce College in the capacity of a lecturer for the past 17 years. At the college, she has played a

vital role in the commencement of a Post Graduate Diploma in Industrial Mathematics, a course that has specially been designed as per the requirements of the industry.

In addition to her college duties, she has to her credit a number of research papers, as an author and co-author, on Topology and Fuzzy Systems and has attended multiple conferences and delivered guest talks at those venues. From 2006–2008 see was Recorder of the ICT Section of Indian Science Congress Association.

She holds the membership of renowned academic societies. Through the forum of Rotary Club of Ahmednagar, she has been a part of the team that has conducted several workshops for the various strata of the society. For her all round efforts, she received the '*Khandesh Maitri VidyaBhushan Pursakar'* in December 2005 from the Khandesh Mitra Mandal of Ahmednagar.

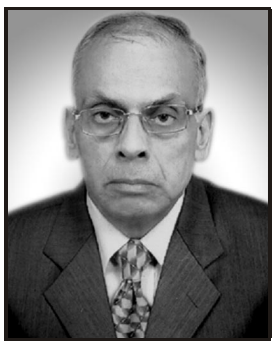
PROF. I. MANNA

President
Section of Materials Science

Indranil Manna received his Ph. D. degree from the Indian Institute of Technology (IIT) Kharagpur in 1990. Earlier, he obtained his bachelor's (B. E.) and master's (M. Tech.) degrees from Calcutta University and IIT-Kanpur in 1983 and 1984, respectively. Prof. Manna worked at the Mishra Dhatu Nigam, Hyderabad before joining IIT-Kharagpur in 1985. Since then, he has been at the same Institute as Lecturer (1985-1990), Assistant Professor (1990-1997), Associate Professor (1997-2003) and a Full Professor (2003-present). In between, he worked as guest scientist in different renowned Institutions and Universities abroad like Max Planck Institute at Stuttgart, Technical University of Clausthal, Nanyang Technological University, Liverpool University, University of Ulm for periods up to one year. Prof. Manna teaches courses on phase transformation, surface engineering, X-ray diffraction, etc. His research interest concerns structure-property correlation in engineering materials including synthesis/ application of nano-materials, surface coating/ engineering, phase transition, oxide fuel cell, bainitic steel and modeling. His current activities on amorphous/nanocrystaliine Al-alloys, nano-fluid and laser/plasma assisted surface engineering have evoked wide interest in the scientific community. He has published about 200 peer-reviewed papers, supervised 14 Ph. D, 32 M. Tech. and 45 B. Tech. theses, carried out 34 sponsored projects and recently obtained a patent on amorphous AlCuTi alloy. Prof. Manna won several prizes and awards in India and abroad including INSA Medal for Young Scientists, Young Metallurgist and Metallurgist of the Year Awards, MRSI Medal, AICTE career award and DAAD and Humboldt Fellowships, Acta Materialia Best Referee Award. Currently, he is the Coordinator, Nano Science and Technology, and the Chairman, Central Research Facility, IIT, Kharagpur.

Prof. Manna has been elected a Fellow (FNAE) of the Indian National Academy of Engineering (INAE), New Delhi, a Fellow (FNASc) of The

National Academy of Sciences of India, Allahabad, and a Fellow (FASc) of the Indian Academy of Sciences, Bangalore. The German Academic Exchange Service (DAAD), Bonn appointed him an Honorary DAAD Advisor in India for three years, INAE selected him for INAE-AICTE Distinguished Industry Professorship for 2007-08 to work with Tata Steel, and Indian Institute of Metals (IIM) has conferred the GD Birla Gold Medal (2008) on him. Recently, INAE has awaded him the prestigious *INAE Visvesvarya Chair Professorship* for two years.



PROF. A. K. AGARWAL

President
Section of Mathematical Sciences
(including Statistics)

Ashok Kumar Agarwal was born on August 28, 1949 at Moradabad, Uttar Pradesh. After completing his B. Sc. and M. Sc. from Agra University in 1969 and 1972 respectively, he received his Ph. D. from IIT. Delhi in 1981. He pursued Post Doctoral research at the Pennsylvania State University, USA during 1984-86 on a National Scholarship for Higher Study Abroad, Ministry of Education & Culture, Government of India. After the completion of the term of his fellowship, he served the Pennsylvania State University as an Assistant Professor of Mathematics for four years (1986-90). He held visiting positions at IIT, Delhi, Matscience, Chennai and Mehata Research Institute, Allahabad during 1990-92. He has worked as an Associate Professor at BITS, Pilani in 1993-95 and chaired the Mathematical Sciences Division at the Institute of Advanced Study in Science and Technology, Guwahati during 1996-98 and is presently a Professor at the Centre for Advanced Study in Mathematics, Panjab University, Chandigarh.

Professor Agarwal has own numerous honours and distinctions. He was included in Marquis' Who's Who in East America in 1990. He has delivered the Ramanujan Memorial Award Lecture in the 64th Annual Conference of the Indian Mathematical Society in 1998.

He has delivered lectures at numerous foreign Universities. He was a Council Member of the Ramanujan Mathematical Society during 1998-2001 and the President of the Indian Mathematical Society during 2008-09. He is presently the President and the Editor-in-Chief of the Society of Special Functions and their Applications. He has published over 70 research papers in reputed journals from all over the world and published seven books as author/editor.

Among his research contributions are 'Partitions with n + t copies of n', 'Infinitely many analytic as well as combinatorial identitites of Rogers-Ramanujan type', 'Factorization patterns of polynomials over finite fields', Ramanujan type congruences for perfect partitons', 'Generating functions for families of basic hypergeometric functions', 'Combinatorial properties of mock theta functions of Ramanujan' and 'n-colour Compositions'.

DR. T. K. BOSE

President
Section of Medical Sciences
(including Physiology)

Tapas Kumar Bose has been associated with the discipline of Forensic Medicine as a teacher and medico legal expert for the last 28 years. He has contributed a good number of articles in various scientific journals, both national and international. He attended and presented papers in numbers of national and international conferences.

As a forensic pathologist he had performed and supervised thousands of autopsy and established himself as medico legal expert in different courts of law. He has organised lot of scientific activities, seminars and workshops in the capacity of organising chairman/secretary. He was trainer and resourse person in lots of Child Abuse and HIV programme, He was chairman of many enquiry committees and in board of interview for PSC West Bengal, UPSC, Jharkhand PSC and BHU. He is an Inspector of Medical Council of India.

He acted as examiner/paper setter of various universities in the state and outside for undergraduate and post graduate examinations, and PhD viva voce and thesis examiner. He has also acted as examiner outside the country. He is at present council member of Indian Academy of Forensic Medicine, Indian Academy of Forensic Science, Indian Society of toxicology and Member of Editorial board of Five National and international Journals and Convenor Post graduate Board of Studies in Forensic Medicine of University of Health Sciences, Kolkata.

He also participated in public awareness programmes organized by Doordarshan, All India Radio, Banks and contributed articles in publications for the common people. He is the co author of a book "Medicolegal aspects of health care delivery system" and contributed chapters in different books. He is also serving Indian Army in the capacity of Lt. Col in Territorial Army in Army Medical Corps.

DR. P. K. SETH

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

P. K. Seth obtained his B. Sc. and M. Sc. (Biochemistry) from Lucknow University, pursued his research in the field of Biochemical Pharmacology at K. G. Medical College, Lucknow and obtained his Ph. D. in 1967. After serving Chicago Medical School, Chicago as Research Associate and Assistant Professor from 1967-71, he joined Industrial Toxicology Research Centre, Lucknow as senior scientist in 1971 and served as its Director from 1997 to 2003. He is Adjunct

Professor at Department of Elementology and Toxicology, Jamia Hamdard University, New Delhi and Professor of Biochemistry in the Department of Biochemistry, Lucknow University.

Dr. Seth made significant contributions to molecular biology and biotechnology related to health sciences particularly understanding the effect of chemicals and drugs on the nervous system. He introduced concepts of mechanistic toxicology for assessing risk to toxic substances and the need to identify the target molecules to serve as markers of exposure and prediction of adverse effects of chemicals. His studies led to understanding of the mechanisms of toxicity (monomers like acrylamide, metals like manganese and mercury and pesticides like endosulfan and lindane). His recent studies demonostrating expression of cytochrome P450 isoenzymes in mammalian lymphocytes opened up new avenues for identifying individuals susceptible to chemicals due to cytochrome P450 polymorphism.

In recognition of his contributions, Dr. Seth has been elected fellow of Indian National Science Academy (INSA), National Academy of Sciences, India (NASI) and National Academy of Medical Sciences, India (NAMS). He is the Past president of the Society of Toxicology (India), Environmental Mutagen Society of India (EMSI) and currently is the President of Indian Network for Soil Contamination Research and Uttar Pradesh Association for Science and Technology Advancement (UPASTA). He is a Founder Fellow and Past President of Indian Academy of Neurosciences. He has received prestigious awards like Raj Kristo Dutt Memorial Lecture Award of Indian Science Congress (2002), Norman Dill Award of Society of Biosciences, Vigyan Gaurav Samman (2004) of Government of Uttar Pradesh ; Prof. B. K. Bachhawat Life Time Achievement Award of Indian Academy of Sciences (2006) ; Oration Award of Association of Biochemists of India (2006) ; Toxicology Award of the National Academy of Science (2007) and P.C Ray Gold medal of Indian Science Congress Association (2007).

He has published over 240 research papers, contributed over 50 review articles / book chapters & reports and holds 10 patents. More than 30 students have worked under his supervision for their Ph. D.

DR. S. BEHERE

President
Section of Physical Sciences

Subhas Behere is Professor and former Head of the Department of Physics at the Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra. He is also working as a director of UGC-Academic Staff College of the university. He obtained M. Sc. degree in 1971 from the Marathwada University and Ph. D. degree in 1978. His special interests are in Molecular spectroscopy and has carried out elaborate work in the field of high resolution rotational spectroscopy, vibrational

spectroscopy, potential energy functions, Franck Condon factors and work related to other molecular interactions. During his research work he was the sole person behind the construction and fabrication of a 35ft Concave grating spectrograph, which is considered to be a unique instrument in the country for high resolution optical spectroscopic studies. Many students have obtained Ph. D. working with the help of this spectrometer. Dr. Behere had the rare opportunity of working with renowned spectroscopist like Professor B B Laud and had interactions with other famous spectroscopists. He has also made substantial contributions in the field of Fractal growth and Simulation studies. Presently he has undertaken the study of noise pollution in the Aurangabad city especially due to vehicular traffic. He has published around 50 research papers in reputed international journals and has guided 15 Ph. D. students. He has attended several conferences and chaired many sessions. He was a UGC visiting fellow at Sant Gadgebaba University, Amaravati and Saurashtra University, Rajkot. He has collaborative research work with the HPPD of BARC Trombay, Mumbai and was also an associate of IUCAA during 1992 to 1995. He is life member of many societies.

He is a referee for national and international journals as well as for Ph. D. thesis of various universities. He is also interested in popularization of science for which he lectured at many colleges and universities, delivered 60 radio talks on All India Radio, Aurangabad and wrote several articles in newspapers on current sciences topics in English and Indian languages. He is also the director of the Mahatma Phuley Center of the university. He was sectional recorder of the Physical Sciences of the Indian Science Congress for 2007 and 2008. His hobbies include philately, bird watching and Indian classical music.

PROF. P. TANDON

President

Section of Plant Sciences

Pramod Tandon is presently Vice-Chancellor of North-Eastern Hill University (NEHU), Shillong.

Prof. Tandon received his B. Sc. degree in 1969 and M. Sc. (Botany) in 1971 from Lucknow University. He obtained his Ph. D. degree on the process of gall induction in plants and the factors involved from Jodhpur University in 1976. The seminal contributions of Prof. Tandon on gall tissues put forth the evidence that high levels of 'auxin protectors' account for both unregulated cell division and anaplasia associated with tumor tissue. In 1977 he joined the North-Eastern Hill University as a faculty member. He was awarded the prestigious National Scholarship for Study Abroad by Government of India and worked as a post-doctoral fellow in the Department of Molecular Biology and Biochemistry at the University of California, Irvine, USA during 1978-79 and studied the genome organization and expression of chloroplast DNA.

Prof. Tandon has made outstanding contribution in mass micropropagation, reestablish ment and

recovery of Indian endemic plants from north eastern region that are critically endangered in their natural habitat. Besides developing protocols for rapid propagation of some forest trees and orchids, his research group has also developed an embryogenic system for afforestation of *Pinus Kesiya*, which has tremendous application in clonal forestry. He has published more than 100 research papers and articles in journals of both national and international repute. He has edited 3 books on biodiversity and biotechnology. He has trained a large number of M. Sc. and Ph. D. students in the field of Plant Biotechnology over the last thirty five years.

Prof. Tandon established the Bioinformatics Centre (funded by Department of Biotechnology, Government of India) at NEHU in 1999, which is involved in preparation of databases on rich biodiversity of the region.

He is credited for successfully organizing the 96th Indian Science Congress held during January 2009 by NEHU, the first ever in the entire northeastern region.

Prof. Tandon is a Fellow of the National Academy of Sciences, India and Indian Botanical Society besides being a member of many Academic bodies and National Task Forces including the Scientific Advisory Committee to the Cabinet, Government of India. Prof. Tandon is the recipient of many prestigious awards and recognitions, notably : Science and Technology Agency Research Award for Foreign Scientists by Prime Minister's Office, Government of Japan ; Platinum Jubilee Lecture Award of Indian Science Congress Association ; B. P. Pal National Envrionment Fellowship Award on Biodiversity, Ministry of Environment & Forests, Government of India ; Professor Panchanan Maheshwari Medal Award of Indian Botanical Society ; Dr. T. N. Khoshoo Memorial Lecture Award of The Orchid Society of India ; Gadgil Memorial Lecture Award of Plant Tissue Culture Association of India ; Professor R. N. Tandon Memorial Lecture Award of the National Academy of Sciences, India ; Award of Millennium Plaques of Honour of Indian Science Congress Association, and Padma Shri (2009) a civilian award.

Conferences / Meetings / Symposia / Seminars

National Conference on Education and Research (ConfER 2010) March 6–7, 2010, Jaypee Institute of Engineeing and Technology, Guna (MP), India

Theme : "Impact of Globalization and Privatization on meeting India's IT Human Resource needs"

Globalization has deep and widespread effects on all aspects of human life and, especially, on the world economy. These effects are to the extent that in our era all spheres of economic and political development are influenced explicitly or implicitly by this process and its implications. If we consider privatization as one of the main requirements for economic development, it has to be dealt with and studied in close relationship with the globalization process.

Contact : Dr. Vipin Tyagi, Convener–ConfER 2010, Dept of Computer Science, Jaypee Institute of Engineering and Technology, Raghogarh Guna (MP), Phone : 9826268087, emil : dr.vipin.tyagi@gmail.com

International Conference on Advances in Computer Engineering, ACE 2010, 20-21 June, 2010, Banglore, India. The Association of Computer, Electronics and Electrical Engineers.

International Conference on Advances in Computer Engineering, ACE 2010, is an international conference where theory, practices, and applications of Computational Engineering, Computer and Telecommunication Technology and related topics are presented and discussed. Original contributions are solicited on topics covered under broad areas such as (but not limited to) :

Computational Mathematics, Data Structures, Algorithms, Artificial Intelligence, Automated Software Engineering, Bioinformatics and Scientific Computing, Compilers and Interpreters, Computational Intelligence, Computer Animation, Computer Architecture, Computer Architecture and Embedded Systems, Computer Games, Computer Graphics & Virtual Reality, Computer Modeling, Computer Networks, Computer Security, Computer Simulation, Computer Vision, Computer-aided Design/Manufacturing, Computing-Ethics, Computing Practices & Applications, Data Communications, Data Compression, Data Encryption, Data Mining, Databases, Digital Signal Processing, Distributed Systems, Event Driven Programming, Expert Systems, High Performance Computing, Image Processing, Watermarking, Information Retrieval, Information Systems, Mobile Computing, Multimedia Applications, Natural Language Processing, Parallel and Distributed Computing, Performance Evaluation, Programming Languages, Reconfigurable Computing Systems, Security & Cryptography, Software Engineering & CASE, Theoretical Computer Science, Applications of Computer Science and Engineering.

Prospective authors are invited to submit full (original research) papers (which is NOT submitted/publised/ under consideration anywhere) in electronic (PDF only) format through the easy chair conferences management system website or via email aceee.ace.paper AT gmail.com. Papers may be submitted : aceee.ace.paper@gmail.com.

S & T ACROSS THE WORLD

CHANGES IN PLUTOID ERIS

A team of astronomers led by Stephen Tegler from the Northern Arizona University in Flagstaff was culling through pictures of the biggest dwarf planet beyond Neptune, called Eris, when they came across a startling discovery. The small plutoid sported major changes in its surface composition, as indicated by some pictures taken at different points in time, separated by a two-year period. The first set of spectroscopic imagery was captured in 2005 thanks to the 4.2-metre William Herschel Telescope located in Spain, while the second was obtained in 2007 by means of the Arizona-based 6.5-metre MMT observatory. The analysis based on the photos suggests a rapid and major alteration in the concentration of frozen nitrogen on Eris. At the moment, the plutoid is situated at its orbital point farthest from the Sun, about 100 astronomical units far from the system's star. Considering that it takes 557 years for Eris to complete a full orbit cycle, it is easy to conclude that the influence of the Sun has not changed during the recent several years, which rules out the possibility that this phenomenon is some what linked to the sun's activity or influence on the plutoid.

(http://news.softpedia.com, Nov 12, 2008)

SMALLEST HOME CINEMA SYSTEM

Tanfel of Germany has developed the System 5THX Select 5.1, smallest home cinema set. The latest generation of the System 5 THX Select is suitable for rooms up to 50 square metres and combines both affordability and top quality sound. This set is currently heavily reduced in price. Comprising of an ultra compact THX spcified subwoofer with a 600 watt amplifier, and five satellite speakers, makes this system ideal for consumers who want a compact home system, with proven THX quality at an unbeatable price. System is nicely designed to compliment most decors and slot into any home environment. Teufel is reported to be European's leading direct seller of loudspeaker systems.

(http://www.bit-tech.net.news, Dec 6, 2008)

ENERGY SAVING HOMES

In Atlanta, builders are pushing what the head of the Greater Atlanta Home Builders Association calls 'high-performance homes' that sip water and electricity like a Toyota Prius might sip gas. In Austin, Texas, custom home-builders like Ray Tonjes, are adding energy-saving features like thicker insulation, sealed attics and duct work, and dual speed air conditioner compressors to meet customer demand for more energy efficient houses. In Florida and other states, production builder Shea Homes Inc now offers free solar panels in some housing lines, which it claims can cut energy costs by 60% from similar-sized houses from other builders.

Newtypes of supplies, everything from insulation and sheathing to govenment-sanctioned 'Engergy Star' appliances and solar panels that are much less obtrusive, are making building energy efficient homes a lot easier. Tonjes, the Austin builder, has been constructing 'green' houses for more than two decades. But today, both consumer interest and availability of energy efficient building supplies and systems have reached a new high. Everyone is more attuned to energy. It thus has become an emerging issue.

(Financial Express, Nov 10, 2008)

TOMATOES WARD CANCER

A team at the John Innes Centre in Britain has created the GM tomatoes with antioxidants from plants given genes from the snapdragon, a garden flower, which enable them to produce a type of nutrient that may protect against cancer. This is one of the first examples of GM organism with a trait that really offers a potential benefit for all consumers.

The new tomatoes are coloured deep purple. This is because, in the snapdragon, the function of genes is to produce anthocyanins, the pigments that give the flowers their deep colours. According to the scientists, anthocyanins offer protection not only against cancers but also cardiovascular disease and age-related degenerative diseases. After trying mice, it is now planned to test them on humans.

(International Science Briefs, Nov 16-30, 2008)

ANTI-COLLISION TECHNOLOGY FOR CAR

Ford has a new concept for car technology, i.e, its own version of anti-collision device. Its latest safety breakthrough–collision warning with brake support is coming in the year 2009. The forward-sensing radar system that anticipates emergency events and appropriately reacts via audio prompts and also to the braking system, is now a new thing. What is new with this technology is its use of the rear backup sensors when backing. This detects approaching cars. This is an impressive technology.

Point to ponder, however, is whether the roads will become 100% free of crashes if cars are created with this technology. It is felt that a greatest anti-collision technology a car can have will always be its driver.

(http://carblog.classifieds1000.com/ford, Oct 15, 2008)

ANSWERS TO "DO YOU KNOW ?"

A1. About 4 millions times.

A2. Can be as high as 30,000° C.

A3. Coal being burnt in thermal power plants and bauxite leached by sodium hydroxide during aluminum extraction.

A4. 1,000,00 according to researchers, 99% unknown (Know how, Telegraph, September 5, 2005.)

A5. Russia.

A6. About 120 miles/hour.

A7. 1/100 th of a second.

A8. Lie detector.