EVERYMAN'S SCIENCE

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COVER PHOTOGRAPHS ***(From the Left)***

Past General Presidents of ISCA

1. Prof. N. R. Dhar	**(1961)**
2. Dr. B. C. Guha (died pre-maturely)	**(1962)**
3. Dr. B. Mukerji	**(1962)**
4. Prof. D. S. Kothari	**(1963)**
5. Prof. Humayun Kabir	**(1964-65)**
6. Prof. B. N. Prasad	**(1966)**
7. Prof. T. R. Seshadri	**(1967)**

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EDITORIAL

CYSTICERCOSIS AND EPILEPSY : NEED FOR BETTER SANITATION, PERSONAL HYGIENE AND SWINE HUSBANDARY PRACTICES

Taeniasis/Cysticercosis, a complex zoonosis, is a major public health problem in many developing countries of Asia, Africa and Latin America[1]. Cysticercosis is caused by *Cysticercus*, the tissue cysts of the pork tapeworm, *Taenia solium*. Man is the only definitive host harbouring the adult, *T.solium* in the upper part of small intestine. Ova are passed out in faeces and subsequently consumed by intermediate host, the pig, while grazing in the contaminated fields. Within the gut of the pig, these mature into larval forms and penetrate the intestinal wall, gaining entrance into lymphatics and veins and develop in the muscles and other organs. Human beings can also act as an intermediate host by ingestion of eggs contaminating vegetables, fruits or water, besides by autoinfection or by reverse peristalsis in the infected host harbouring adult worms. The ingested ova (eggs) hatch into larval forms called oncospheres, which penetrate the intestinal wall, gain entrance into lymphatics and blood vessels, and subsequently lodge in subcutaneous tissues, muscles, brain, eyes and other organs of body, where they further develop into mature cysts (cysticerci) in about 10-12 weeks. These cysticerci are oval in shape with single scolex bearing four suckers; their size depends on the type of tissue they invade.

Despite the great impact on public and animal health as well as on the economy of the country, epidemic aspects of cysticercosis are not exactly known, since its notification in humans is not mandatory and number of meat inspection services are limited in many areas, resulting in high percentage of non-inspected meat market. There is no information available on its frequency in animals slaughtered without inspection. Since several animals are reared as pet animals, there are greater chances of cysticercosis in such animals than in those slaughtered under inspection. Further, the exact prevalence of the human disease cannot be evaluated due to innumerable difficulties in terms of biological, statistical and technical problems besides number of asymptomatic cases and insignificant immune response evoked against the parasite in infected population. The prevalence is dependent on various socioeconomic and cultural variables and sanitation facilities in the pig rearing areas. Cysticercosis is related to a few of the most burning problems in the world today: poverty in the marginal rural regions with subsistence animal husbandry and migration from rural to urban areas or from developing to developed countries. The WHO considers it a serious problem when the level of people infected with *Taenia solium* is more than 1 per cent. There is limited information available on the epidemiology of taeniasis/ cysticercosis in India. Prevalence of cysticercosis in a population is influenced by the prevalence of *T.solium* infestation. Studies reveal that 0.5-15% patients in northern India[1,2], 0.9% on sewage farm workers in Lucknow[3], 0.36% in Pondicherry[4] and 0.8% subjects in lower socio-economic group in Chandigarh[5] harbour adult worms. Higher prevalence has been reported in pig rearing areas compared to the non-pig rearing areas[2].

Clinical manifestations vary depending on the organ involved. Many infected individuals may be asymptomatic while symptomatic patients can be divided into four groups namely disseminated, opthalmocysticercosis, neurocysticercosis and mixed cysticercosis depending upon the localization of the parasites. Generally, the cysts occurring outside the central nervous system (CNS) are of minor clinical significance, but their development in the eye, may lead to blindness and infection in the CNS may result in neurocysticercosis (NCC). Human NCC is regarded as the most common parasitic disease of the CNS in many parts of the world[6] including India leading to high morbidity and mortality [7]. Approximately, 50 million persons are infected worldwide and about 50,000 die from NCC yearly. In Indian subcontinent, different clinical presentation in NCC patients is reported. Without any doubt, epilepsy appears to be the most important presentation in about 70% of patients and parenchymal cysts outnumber the ventricular forms[1,8-10]. These cases show evidence of parenchymal cysticerci with associated oedema or enhancement corresponding to the granular nodular stages. NCC is an important cause of late onset epilepsy. Approximately 50% of patients present with meningitis, which may lead to extremely serious disease and often, has a chronic course.

Subcutaneous cysticercosis can be easily diagnosed by fine needle aspiration cytology and biopsy examination. However, cysts in vital organs limit this technique in routine diagnosis[11]. Clinical symptoms, substantiated by radiological reports and/or serological evidence, often lead to confirmatory diagnosis. Computed tomography and magnetic resonance imaging have limitations[12-14] besides their non-availability at many diagnostic centers. Single ring enhancing lesion (SSEL) has been observed in several patients in India in contrast to multiple lesions in western countries. A battery of immunodiagnostic techniques is being used extensively to detect humoral immune responses to the parasite antigens. Earlier reports with the use of crude soluble extract antigen indicated variable sensitivity and specificity[2,7]. Attempts with the use of purified antigenic fractions and extretory secretory antigens[15] have yielded promising results. The antigens of low molecular mass of 18, 20 and 24 kDa yielded 95% sensitivity and 100% specificity[16]. Enzyme Immuno Transfer Blot (EITB) found to be 100% sensitive for detection of antibody response in multilesional NCC patients may be of limited value for routine diagnosis in India, especially due to the fact that in Indian subcontinent NCC patients with SSEL predominate than with multilesional cysticercosis.

The treatment of choice for cysticercosis is excision wherever possible and as soon as possible. In the event of ocular cysticercosis, operation for removal of the cyst is indicated. Albendazole (15 mg/kg/day X 30 days), Praziquantel (30 mg/kg body weight X 15 days) and Matrifonate (7.5 mg/kg body weight X 5 days) are the effective larvicidal agents with their own merits and demerits. Treatment modalities for human neurocysticercosis are controversial. Few studies suggest that definitive treatment is indicated only in those who have progressive active disease or one of its fulminant forms and rest can be managed symptomatically with antiepileptic treatment[17]. Albendazole therapy does not alter the resolution pattern of single small enhancing lesion[18], however, it should be considered in patients with multiple lesions[19]. Few reports on the other hand have documented the dramatic regression of lesion causing mass effects with Albendazole or Praziquantel. In conclusion, it is suggested that because of the variability in presentation, the consideration for treatment should be individualized.

The following methods are suggested to prevent its occurrence in humans[20]:

1. **Mass Education :** Emphasis should be placed on education and general awareness about the zoonosis: the ways to prevent excrement from being deposited in places where pigs can gain excess to it; to use latrines and general hygiene measures, especially related to washing hands; to cook or fry all pig meat before consumption; to use an anthelmintic treatment whenever white spots are noticed on excrement; and treatment with iodine, or other disinfectant, of raw vegetables and fruits that cannot be peeled, whenever there is doubt about the origin of the food.
2. **For pig keepers :** Education and general awareness on the role of pigs in maintaining the life cycle of the parasite; to keep pigs in a separate place; not to use pigs as cleaners of human dirt.
3. **For municipalities :** The traditional control methods in the markets not being enough, should be complemented and enforced; to introduce strict measures related to meat control, especially in backyard slaughtering; control of the use of wastewater.
4. **Vaccine studies :** Attempts on vaccine studies for use in pigs are in experimental phase. Immunization with the recombinant *T. ovis* antigens induced 93% protection against the establishment of viable cysticerci and 74% protection against the total number of cysticerci. The results support the possibility of developing a vaccine for the control of transmission of *T.solium* through pigs.

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Prof. Nancy Malla

and

Prof. R. C. Mahajan

"I am like a child hunting for sea shells when the entire ocean of knowledge lies unexplored in front of me".

—Issac Newton

PRESIDENTIAL ADDRESS

SCIENCE AND THE STATE IN INDIA

PROF. HUMAYUN KABIR

I am deeply grateful to the members of the Indian Science Congress Association for the honour they have done me in electing me President for the year. When I think of the many eminent scientists who have adorned this seat, my embarrassment becomes the greater, for I do not possess even a first degree in science. The only reason for your choice may be that during the last few years. I have to the best of my abiliy tried to serve the cause of Science in India. I have therefore accepted your invitation in a spirit of humility and am beholden to you for this gracious gesture.

The Indian Science Congress has in the past had many distinguished Presidents and among them, Jawaharlal Nehru will occupy a position of special eminence. A student of Science all his life, he may not have made a personal contribution to any field of scientific research but perhaps no one in India has done more for Science and scientists than our late Prime Minister. He devoted himself to the task of inculcating in the Indian people the scientific spirit and removing from their minds the attitude of superstition and fatalism which has so often sapped Indian vatality. He sought to infuse into our economy, politics and society the critical, objective and analytical approach of Science. Science is essentially rational and according to him, the extension of the rational principle to every sphere of human activity is necessary for the prosperity and indeed for the survival of man.

It is in this spirit that throughout his life, Nehru worked for the development of Science in India. Our magnificent National Laboratories devoted to research in Sciences and their application to industry, agriculture and generally to human life stand as a permanent, monument to his vision and his faith. We of the Science Congress owe him a special debt of gratitude. From the inception of independence, he attended every single session of the Congress excepting two. We miss him today and shall always miss him, for he spoke to Scientists as a fellow worker in the cause of Science. In Jawaharlal Nehru's death, Indian Science has lost one of its greatest supporters and friends.

Another great figure whose name comes to my mind on this occasion is that of Asutosh Mookerjee. He was himself a Mathematician of eminence, but his major service to Science lay in the encouragement and support he gave to research by others. An educationist, of international standing, he was primarily responsible for developing postgraduate studies and research in Indian Universities. Some of the most notable names in Indian Science were attracted to a life of study and research under his direct inspiration. The creation of the University College of Science and Technology at Calcutta is one of the shining monuments to his love of Science and industry. The Indian Science

* General President, Fifty-one Indian Science Congress held during January, 1964 at Calcutta.

Congress has a special link with him, for he was the first President of this Association and it is to mark the Centenary of his birth that the Congress is holding its present session in 1964 in the city of Calcutta. I must thank the Vice-Chancellors of the Punjab and the Calcutta Universities whose cooperation and understanding made this happy development possible.

I have said earlier that I am not a student of Science and cannot therefore comment on recent scientific work in any field. There have been startling developments in almost every area of Science but their proper discussion and assessment must be left to specialists. I may perhaps speak to you about some general problems concerning Science and measures necessary for accelerating scientific progress in India. I think there will be general agreement that facilities for study and research in Science have been greatly expanded. The State is offering support and help on a scale that could not have been imagined two decades ago and yet there is a feeling that not enough is being done. The limiting factors, in India as elsewhere, are shortage of personnel and inadequacy of funds relative to demand. The number of scientific workers has enormously increased and yet the output appears inadequate both qualitatively and quantitatively. Similarly, funds are always short as modern Science requires more and more elaborate and sophisticated machines which are costly and difficult to make. Even rich countries like the U.K. or West Germany are finding it difficult to meet all the demands for equipment, for a single piece of apparatus may in some cases cost as much as a hundred million rupees or more.

Before I take up some specifically Indian questions, I may refer generally to a few problems which affect all countries. While the importance of Science and scientific research to modern society is accepted by all, the full implications of the new Scientific Revolution have not always been recognised. Formerly, the advancement of Science was the task of devoted students whose main interest was theoretical research in fundamental problems. Associations like the Royal Society of London have fostered the growth of Science for over three hundred years, but till the beginning of the present century, no country, with the possible exception of Germany, made any effort at the State level to organise scientific research for industrial purposes. In the U.K., it was only the impact of the first world war which led to the establishment of the Department of Scientific and Industrial Research, though private industry both in the U.S.A. and the U.K. had gradually become conscious of the important of research in order to face the competition of research-based German industries. The experience of the first and the second world wars convinced all nations that scientific research is necessary for survival itself.

With the growing recognition of the importance of Science for military, industrial, commercial and other purposes, the State inevitably came into the picture as a conscious agent for promoting scientific research. This meant a growing realisation of the practical utility of Science and yet one of the characteristics of Science is that some of the most spectacular advances have taken place without any reference to practical applicability. Scientific discoveries are as dependent on free imagination as artistic creation. That is why attempts to make scientific research too narrowly utilitarian are foredoomed to failure. Men engaged in scientific research in any field must therefore be given the widest possible freedom. Disinterested pursuit of truth has again and again proved more profitable than, close adherence to prescribed objectives.

State participation often leads to State control and control is not conductive to scientific progress. In spite of this risk, increasing State participation in scientific work is inescapable in the modern world. Research today has become so expensive that it is almost impossible for an individual scientist or even a group of scientists in a University to find

necessary funds. This refers to equipment which is becoming more and more complicated and costly, and even more to the need for documentation services and easy access to the vast volume of research carried out in many languages in many parts of the world. In fact, the scale of expenditure has increased so greatly that the State itself has to exercise economy in the allocation of resources to competing projects.

Practical application necessarily becomes an important consideration in such a context. Even the richest of States finds it difficult to justify and support pure research over long periods unless there are tangible results. This explains why the demand for applied research and development has been continually increasing and there is at times a risk that immediate demands may defeat long-term needs. The only redeeming feature in the situation is that pure research has generally led to results of great practical utility. As such, there has been no real clash between the pursuit of truth for its own sake and the pursuit of truth for its practical results.

I may refer here to another feature which is characteristic of modern research. In earlier times, it was possible for individuals working by themselves to make significant contributions to Science or Technology. In fact, this was often the only way in which Science could advance. Today, with the enormous increase in the body of knowledge and the necessity for cooperative manipulation of data, it is almost impossible for an individual, however gifted, to achieve spectacular success entirely on his own. This is not to minimise the importance of the individual genius, for he will always have a role of the highest importance, but even the, genius today must be supported by colleagues who provide him with the material for his intellectual adventures.

The splendid achievements of the U.S.A. and the U.S.S.R. in the scientific field in the last two or three decades are due primarily to this fact of cooperative research. In both countries, great emphasis has been placed on building up teams and it has been found that the individual as a member of a team can make more significant contributions than when working on his own. This perhaps helps to explain why young Indian scientists who have shown great promise when working abroad do not always justify our hopes after they return. Some become disappointed with conditions here and leave the country and this is naturally a cause for concern. I am convinced that among gifted scientists, those who go abroad for money and position are in a minority. The majority are attracted to foreign countries by the more satisfactory conditions of work and the promise of earlier and greater achievement.

The problem of migration of scientists is not peculiar to India and fortunately for us, it has not yet assumed serious proportions here. Nevertheless, it deserves careful consideration and I may be excused if I digress and dwell on this for a moment. I have discussed this question with leaders of Science in the U.K., Germany, Switzerland and France. I found general agreement that there should be no objection to some circulation of scientists. Under modern conditions, every country should be prepared to allow a few of its promising scientists to work in other countries. Such movement must however be mutual. Objections arise, validly, because it is at present a one-way traffic with most scientists moving to the U.S.A., some of them permanently. Very few from America come to work in other countries.

I will repeat what Professor Heisenberg told me in this connection. He said that apart from the question of easy access to equipment and other material, one major reason for migration of young scientists to the U.S.A. is the existence there of scientific teams which make it easier for a young scientist to make a name for himself. Under modern conditions, it is almost impossible for isolated workers to effect any significant breakthrough. In America, large groups of scientists are working

with the most up-to-date instrumentation and the result is that any worker of first rate ability can hope to make valuable contributions in collaboration with his colleagues.

Professor Heisenberg felt that the only way of checking this tendency of young scientists to migrate to the U.S.A. is to build up effective scientific teams within the country, expand facilities of research in universities and laboratories and improve conditions of service of scientists. This requires planning and coordination by the State and academic bodies and also a great deal of cooperation between older and younger scientists. In addition, it is necessary to give young scientists liberal facilities of travel. Professor Heisenberg said that some of his junior colleagues, visit the United States every year and almost everyone has been given the option of going abroad at least once in two years. In this way, younger scientists are able to keep abreast with the work which is being done elsewhere and one of the major reasons for migration has disappeared.

The conditions which are obtained within a University Department Research Laboratory also have a direct bearing on the movement of scientists. Where there is an atmosphere of freedom, where all participate and are encouraged to participate in discussion and research and the Head takes active interest in the work of his colleagues, a team can be built up quickly. Members in such institutions feel that they are engaged in a cooperative endeavour and generally everybody is active and therefore happy. The individual can make his best contribution in such conditions and the general quality to work in the Laboratory immediately goes up. When on the other hand there is dictation, or in the alternative, indifference or aloofness from above, there is invariably friction at lower levels. In such institutions, scientists, specially the younger one feels frustrated and become incapable of really creative work. I am sorry that I should have to mention this, for it is obvious that discussion, free enquiry and questioning are the basis of any worthwhile scientific work. There must therefore be freedom and equality among scientists working in a team. Some will even then be leaders but the position will be attained by individual excellence and achievement and not by virtue of seniority or office. Status as such is generally a hindrance to scientific work. This applies particularly to India, where the consciousness about status is far stronger than in most western countries.

The question of leadership will even then remain and this is perhaps *the* crucial issue. There are hardly any complaints and certainly no stagnation in Laboratories or University Departments where a leader is both competent and cooperative and encourages his junior colleagues. It is only where there is no atmosphere of creative activity that frictions abound. The creation of such an atmosphere is primarily the work of the senior scientists themselves. The State can help by removing impediments or creating conditions where scientific work can be easily carried out but the State cannot create in scientists the spirit of cooperation or incentive to research.

One measure may however help in this direction. This is the creation of a number of centres of research in each field, subject of course to the limitation of resources in manpower and funds. It is necessary to have several centres of comparable quality, both in order to stimulate internal competition and also to ensure that no important field is ignored. Existence of only one centre in a country generally means that there is hardly any means of judging whether its work is fully satisfactory or not. There may, in addition, be a tendency to gloss over deficiencies and what is more serious, to limit the scope of research because of the personal taste and attainment of the leaders of the centre.

Some duplication may result from the existence of several independent centres, but of the two alternatives of (i) some duplication and (ii) neglect

of some important field, we should prefer the former. I may add that strictly speaking, there can be no duplication in any field of research. Two scientists may attack the same problem, but their background, approach and treatment are bound to be different. Very often, such parallel attempts have led to extremely important discoveries that are complementary. If somebody had interfered with the work of Newton and Leibnitz on the ground that their research work appeared to be duplicatory, the world would have been the poorer for lack of Differential or Integral Calculus. In order however to ensure that the duplication does not become wasteful, scientific councils with representatives of universities, important Government and other organisations and independent scientists may be set up, but this, is a point to which I shall return.

I may now turn to the distinction which is being increasingly drawn between fundamental and applied research. Fundamental research is recognised to be primarily the function of universities and similar scientific bodies. Applied research is generally left to industry or an operative Department or Ministry of Government. This involves the risk that concern with immediate problems may impair the quality of applied research done under their auspices. It was mainly in order to guard against this danger that independent Research Councils were set up in western countries. Because they have as a primary aim research that yields practical results, Governments have found it easier to finance them on the needed scale. Because they have no immediate administrative or executive responsibility, they can view the whole field of research and not be carried away by the need to deal only with day-to-day problems.

The question of the relation of such Research Councils and their Laboratories to the Universities is exercising the minds of scientists everywhere. They all agree that the two main functions of the University are the training of the younger generations and the advancement of knowledge for its own sake. As such, Universities cannot always serve the immediate needs of society, and the Research Councils with their laboratories become unavoidable. If Universities were asked to do the kind of work which the National Laboratories do, they would be diverted from their true purpose and this would be a loss both to the Universities and the nation. National Research Councils and National Laboratories have thus come to stay, especially in the light of the spectacular advances of German industry in the latter half of the nineteenth and the equally striking advances of American and Soviet industry during the last three decades of the present century.

At the same time there is general agreement that if the Research Councils and their Laboratories are isolated from the Universities, the long-term effects are harmful to both. It has been common experience that these Councils and Laboratories start with a great flourish and striking results almost immediately, but after a few years, they seem to lose their initial energy. Professor Heisenberg in Germany and Professor Blackett in London offered a very interesting explanation of this phenomenon. They independently stated that it is the continual influx of young students and the pressures they exert on the accepted ideas of the teaching faculty which keep Universities efficient and alive. In industry generally and to a lesser degree in the National Laboratories, this revitalising factor does not work to the same extent. Even though there are new recruits, they tend to fall in line and accept the pattern already in vogue in the industry or the Laboratory. The result is a kind of "scientific inbreeding". Generally within ten years, and almost invariably within twenty years, these Laboratories tend to become sterile unless they are renewed by exchange of personnel with Universities or the inflow of new men with different ideas and programmes. Steps must therefore be taken to ensure that the Research Councils in India work in the closest cooperation with the Universities.

The limitation of resources is a hard fact everywhere and even more so in India. In view of our shortage of trained manpower and paucity of material resources, we certainly cannot afford duplication of efforts and yet it seems some unnecessary duplication is taking place. The main reason for this is the comparative isolation from one another of Universities, the Council of Scientific and Industrial Research, the Defence Science Organisation, the Agricultural and the Medical Research Councils and the Atomic Energy Commission. Since each works independently and sometimes without knowledge of what the others are doing it is perhaps inevitable that each should go its own way and at times tread on one another's toes. In the U.K., there is a fairly clear demarcation in the functions of the Defence Laboratories, the National Laboratories and the Universities. In terms of resources and personnel Universities devote ninety per cent or so to pure research, some ten percent to applied research and almost nothing to development. For National Laboratories, the major emphasis is on applied research; with some attention to pure research while development is a marginal activity. Defence Laboratories on the other hand are interested almost exclusively in applied research and development, and even more in development than in applied research. Hardly one per cent of the resources of Defence Laboratories are engaged in pure research and only about twenty per cent in applied research. Whenever any theoretical or basic problem arises, the Defense Laboratories use the resources of the National Laboratories or the Universities for the purpose. Development is such an expensive business that Defence alone seems adequately placed to finance it, and hence any substantial diversion of Defence funds for theoretical research is normally regarded as undesirable.

There is obviously need for some central agency in India to advise the State on allocation of functions, programmes and funds among different autonomous bodies engaged in scientific research. The best solution must be to set up an Advisory Body with one representative each of the Research Councils, the Defence Science Organisation, the Atomic Energy Commission and the University Grants Commission plus an equal though slightly larger number of independent scientists of eminence.

Such an Advisory Body of twelve to fifteen members could broadly review the programmes and consider the claims of the different authorities and thus make recommendations for the allocation of funds among them. In addition, it could advise Government in the relative priorities in research and where they can be carried out. This is essential, as experience has proved that in matter of such vital importance, the collective wisdom of a group of experts is more dependable than the advice of a single individual however brilliant and disinterested.

Ultimately, it would of course be for the Government to take the decisions, as these are in the final analysis political. There are no scientific grounds for deciding whether more should be spent on biological or on space research. Nor is there any scientific criterion for deciding whether two or three or ten per cent of the national income should be involved in scientific work. It would however be an advantage for Government to have the advice of an expert body, for it could then consider its recommendations and take its decisions in view of available resources.

Once the allocation to an authority is made, it should be free to distribute it among Universities, Laboratories and other agencies at its discretion. This would ensure the best possible use of available national resources while maintaining the autonomy of the Universities, the Research Councils and other authorities. The existence of such a body would also ensure that there is no undue duplication of Laboratories or programmes nor undue encroachment by one authority on the functions or province of another. Without such an advisory body, there is a real risk that funds may be allocated, not according to the importance or urgency of

projects, but because of the influence or personality of a powerful claimant.

The Indian Science Congress is the most representative body of scientists in the country and I would therefore place for its consideration the following broad conclusions.

1. The State must play an increasing role in the support of scientific research without however trying to influence directly the aims or programmes of scientific organisations or individual scientists. At a Conference of Scientists held in August 1963, it was suggested that at least one per cent of the National income may be earmarked for support of scientific research. This seems to be the bare minimum, if India is to keep abreast with modern developments.
2. Universities have in the past been the main centres of scientific research, but they cannot meet all the requirements of modern society. Special organisations have therefore been set up and the National Research Councils seem to be the most suitable instruments for the purpose provided they work in the closest liaison with the Universities and share in the task of training future generations of scientists.
3. National Research Councils can be most effective when they are given complete autonomy within their own fields and are not limited to programmes of immediate interest to Government or industry.
4. It is necessary to create in the country a number of Advanced Research centres, preferably three or four but at least two, in each major field of Science with necessary staff, equipment and facilities like some free foreign exchange and the freedom of travel abroad for its members.
5. Individual scientists must be given the freedom and indeed encouragement to pursue independent lines of research with special attention to the need of developing the initiative of younger scientists.
6. There should be National Councils in every field of Science with representatives from Government organisations, Universities and other independent Societies in more or less equal proportions and, finally,
7. For effective guidance of scientific research, an Advisory Council consisting of representatives of the various National Research Councils, the Atomic Energy Commission, the Defence Science Organisation, the University Grants Commission and independent scientists should be set up to advise Government on the apportionment of funds to Universities, non-official agencies and the National Councils, the determination of priorities and programmes, and broad allocation of projects among the different bodies engaged in research.

The Indian Science Congress can and ought to take a lead in bringing about a new era in Indian science. Throughout her long history, India has produced many men of the highest genius. The concept of zero and the evolution of the decimal system are among the greatest achievements of the human mind. In Physics and Chemistry also, Indian thinkers have reached great heights. In the fifty years before independence, we had again many brilliant scientists who achieved distinction in spite of severe handicaps. Any country can be proud of names like Ramanujam and Satyen Bose, Birbal Sahni, Meghnad Shah and C. V. Raman. I have named them only by way of example, for there are many others who have made significant contributions in many fields.

In spite of the fact that intermittently there have appeared great names, in Physics and Mathematics, Medicine and Astronomy, Chemistry, Metallurgy and Botany, we have to admit that there has been,

no climate of Science in India till recently. After independence, there has been a great expansion of facilities and resources. Many new universities and laboratories have been established. Many more students are studying Science and the number of research workers has increased substantially. We have some great names living among us and many young men have shown great promise. Nevertheless, India does not yet occupy in the world of Science the position to which her traditions, her numbers and the intellectual quality of her people entitle her. With greater freedom and equality in discussion, with more large-hearted cooperation between older and younger scientists, I am confident that India can produce scientists of whom any country and any age could be proud. Towards that consummation, let the Indian Science Congress make a significant contribution.

TOXIC CHEMICALS IN FRUITS AND VEGETABLES : AN OVERVIEW

R. K. Sharma* P.P. Dhyani** and S. S. Samant*

The contamination of frutis and vegetables due to increasing anthropogenic activities in India is very common. Heavy metals such as cadmium, lead, nickel, zinc, copper, etc. and residues of pesticides such as chlorpyrofis, cypermethrin, carbendazim, endosulfan, etc. have been major contaminants causing hazards to human health and environment. In the present article, an attempt has been made to address the adverse effects of heavy metals and pesticide residues on human health and suggest possible remedies for reducing dietary exposure.

INTRODUCTION

Now a days, presence of chemicals in or on fruits and vegetables has become one of the key issues worldwide particularly in developing countries due to frequent use of agriculture chemicals. Agriculture chemicals such as pesticdes, fertilizers, hormones, antibiotics, etc. and heavy metal contaminated irrigation water, sewage sludge and municipal solid waste composts are used to increase the yield of fruits and vegetables, and ensure the adequate food supply to the growing population in the developing cities of India. Long term dietary intake of toxic chemicals through fruits and vegetables can pose threats to human health. The levels of pesticide residues in fruits and vegetables have been regularly monitored for more than 20 years in India and for the most of pesticides, the minimum time between spraying and harvesting of produce has been set to ensure the safe foods. Most of the essential heavy metals i.e., copper (Cu), zinc (Zn), selenium (Se) and manganese (Mn) become toxic when their concentrations exceed the safe limits, whereas non-essential heavy metals such as cadmium (Cd), lead (Pb), arsenic (As) and mercury (Hg), etc. are toxic even at low concentrations. Pesticides (organochlorine, organophosphate, etc.), polyaromatic hydrocarbons, polychlorinated dibenzodioxin, furan, etc. originating from different sources have tendency to accumulated in fat of the plants and human tissues, and these have beeen identified as the organic contaminants.

The presence of pesticide residues or heavy metals in the vegetables has forced the human being to think about the impacts of pesticides and heavy metals on their health and environment. Therefore, recently, attention on heavy metals and pesticide residues contamination of fruits and vegetables and their growing areas have been increased.

TOXIC CHEMICAL IN FRUITS AND VEGETABLES

Earlier studes revealed that fruit and vegetable crops grown in periurban or suburban areas of a developing or developed cities of India have been contaminated with toxic heavy metals such as Cd, Ni, Pb, Cr, etc[1,2]. The levels of heavy metals in fruits and vegetables depend on the exposure time,

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heavy metals concentrations in soil, air, irrigation water, species and their morphological nature. Sharma et al.[3] have shown that vegetables exposed to contaminated atmosphere at the market have higher levels of heavy metals as compared to the fresh vegetables. The vegetables grown in vicinity of brick kiln industries and near the national higways also showed higher levels of heavy metals in edible crops[4]. A study conducted in periurban areas of India also showed heavy deposition of Cd, Cu, Zn and Pb on surface of vegetables like cauliflower, spinach and lady's finger.[1,3].

Many studies revealed that fruits and vegetables may have the remnants of insecticides above the prescribed levels, which may pose health hazards to the consumers, Pesticides are categorized as organochlorine, organophosphate synthetic pyrethrides and carbametes and among which organochlorine pesticides such as DDT and HCH have broad spectrum of toxicity and residual activities. DDT and HCH are however banned in India but are still used for vector control. Organochlorine pesticides have been used extensively to increase agricultural products by preventing loss due to pests. Indian farmers do not have sufficient knowledge to assess the risks brought about by indiscriminate use of pesticides. ICAR, New Delhi through its network of 17 All India Coordinated Projects on pesticide residues during 1995-1998 showed that 2200 farmgate sample out of 4000 carried pesticide residue. Almost 9% of them have pesticide residue levels above the maximum permissible limits (MRL). The intensity of pesticide residues in the food chain depends on their persistence behaviour and lipid solubility. Organochlorine pesticides are most frequently subjected to ecological magnification as they are more persistent and lipid soluble in nature as compared to other groups of pesticides.

DIETARY EXPOSURE TO TOXIC CHEMICALS

The dietary intake of contaminants depend on both the food habits of the exposed population and concentrations in foods. The factors which influenced the concentrations of the foods are food processing, preparations, seasonal changes, geographical locations, etc. Ingestion of fruits and vegetables contaminated by released toxic metals into the local environments or plants grown in soil containing naturally high levels of contaminants may also be an important source of these contaminants for human being. Hence, dietary intake has been identified as the main route of human exposure to these toxic metals and various residues of pesticides.

EFFECTS OF TOXIC CHEMICALS ON HUMAN HEALTH

Long term consumption of the fruits and vegetables having minute quantities of toxic chemicals may have adverse impacts on human health and environment. The present article has been focused on the very well known contaminants such as Pb, Cd, As and Hg and pesticide residues in general. The article provides the information on the adverse effects of the contaminants on human health which are as follows.

- Lead is one the most dangerous chemicals to the children and adults. Lead exposure in the children and adults can cause a wide range of health problems such as convulsion, coma, renal failure, loss of intelligence and also neurotoxic effects on children and developing fetus. Loss of intelligence quotient points was also reported in children of under five.
- Arsenic is more ubiquitous, found in air, water, fuel and marine life. The dietary human intake of arsenic contained in food varied from 0.5-1 mg with the greatest concentration coming from fish and crustaceans. Once the arsenic enters into body, it binds with haemoglobin, plasma proteins and leucocytes and redistributed to liver, kidney, lungs, spleen and intestine. Trivalent arsenic is more toxic than the pentavalent or zero valent arsenic.

Arsenic accumulates mainly in soft tissue such as liver, kidney, spleen and lungs. Major storage site of arsenic is keratin rich tissues such as skin, hairs and nails. Acute arsenic poisoning is responsible for its lethality, destruction of blood vessels and gastrointesinal tissues, and also effects heart and brain. Chronic exposure to low does of arsenic causes unusual patterns of hyperpigmentation, peripheral nervous damage, weakness of hands and feet and diabetes. Chronic exposure is responsible for skin and liver cancer in human.

- Cadmium is present at very low levels in a wide variety of foods and other products that accounts for more than 90% of human exposure to cadmium, except in the vicinity of cadmim emitting industries. Acute exposure to high does of cadmium causes severe respiratory irritation. Chronic exposure to cadmium is responsible for lung disease, testicular degeneration and prostrate cancer. Increased cadmium accumulation in human body may cause bone fracture (itai-itai), decreased bone density and height loss in both the male and female.
- Mercury, an environmental contaminant is present as methyl mercury in fish and sea food products. Other foods also contain mercury but mostly its inorganic form which is considerably less toxic than methyl mercury. Exposure to high levels of mercury can lead to life threatening injuries to lungs and nervous systems. At lower but more chronic levels of exposure cause excitability, memory loss, insomnia, timidity and some time delirium. Organic mercury gets bioaccumulated in fish and whale meat which have crossed the placenta and appears in breast milk and may pose risk to the health of newborns.

The provisional tolerable weekly intakes of four heavy metals are given in Table 1.

Table 1 : Provisional Tolerable Weekly intake (mg/kg body weight) values of selected toxic metals for adults[5].

Hazardous metals	Provisional Tolerable Weekly Intake
Arsenic (Total)	15.00
Cadmium	7.00
Lead	25.00
Mercury	16.00

- Acute pesticide exposure includes headache, dizziness, thirst, excessive salivation, nausea, stomach cramps, vomiting, diarrhoea, eye irritation, blurring of vision, construction of pupils, skin irritation or burns, anaemia, weakness, fatigue or exhaustion, feeling of constriction in throat and chest, wheezing, coughing, rapid or weak pulse, trembling, muscle twitching, seizures, mental confusion, inability to breathe, blue lips or face, lose of reflexes, slurred speech, staggering gait, restlessness, apprehensive, excitability, unconciousness, and allergic response.

Keeping in view, the adverse effects to heavy metals and pesticide residues, following points may be suggested to the consumers for reducing their potential dietary exposures to toxic chemical contaminants.

- Grow your own fruits and vegetables.
- Variety of fruits and vegetables should be utilized instead of restricting to one or two fruits and vegetables.
- The fruits and vegetables should be washed properly to remove the chemical contaminants deposited on them.
- Organic fruits or vegetables should be purchased as these are grown without the use of synthetic chemicals or pesticides.
- The fruits and vegetables with high fat content should be avoided.

- Remove peels of fruits and vegetables or the outer layers of leaves.
- Boiled or cooked fruits and vegetables should be consumed rather raw ones.
- The fruits and vegetables grown in the areas prone to contamination should be avoided.

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FOOD SAFETY : STEPS OF RISING CONCERN

Santanu De*

Food safety happens to be one of the most important issues of global concern at present. All necessary measures undertaken to ensure food safety should aim at combating any possible outbreak of food-borne disease raising concerns of food safety issues around the globe, with special focus on developing nations like india.

INTRODUCTION

Surveillance of chemical and biological contaminants of foods is important for public health as well as due to the adverse economic impact of contamination. For developing countries like India, lack of balanced diet too can cause permanent physical or mental disabilities, particularly in the early years of development of an individual. Therefore nutritional security happens to be extremely important across the entire world.

Food Safety program aims at improving health of the population by reducing incidences of food-borne illness. The objectives of the program are to ensure that food is prepared, stored, and served in a manner consistent with accepted public health practices and to stop the sale or distribution of food unfit for human consumption by reason of diseases, adulteration, impurity or other cause. With the recent agreement on Sanitary and Phytosanitary (SPS) measures, World Trade Organization (WTO) has made it mandatory for all member states to follow international food standards guidelines for foreign trade[1]. An important element of these guidelines is the compliance with Hazard Analysis and Critical Control Points (HACCP), a management system for food safety. Indians firms will have to adopt these guidelines.

The seven principles that produce the HACCP plant best suited to a plant or a process are :

Principle 1 : Conduct Hazard Analysis

Types of hazards in food include :

- Biological : (micro) organisms e.g. bacteria etc.
- Chemical : natural toxins e.g. aflatoxin contaminants-e.g. pesticides plastic, metal etc.
- Physical : flints, stones, glass.

Principal 2 : Identify Critical Control Points (CCP)

Principal 3 : Set Critical Limits for Preventive Measures Associated with each CCP based on parameters such as :

● Time/temperature ● Humidity ● Water Activity ● pH levels ● salt concentration ● Chlorine level

Principle 4 : Establish Monitoring Procedures (eg., if the pH level in milk is steadily rising

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though within the critical limits, action has to be initiated to prevent this trend from exceeding the critical limit.)

Principle 5 : Establish Corrective Actions.

Principle 6 : Establish Record Keeping Procedure

Principle 7 : Verification and Validation of the System.

The golden rule of food safety[2] are the following :

- Choose processed raw materials.
- Cook food thoroughly.
- Serve cooked food as soon as possible.
- Store cooked food at temperatures beyond danger zone.
- Reheat cooked food thoroughly.
- Avoid cross-contamination.
- Be clean, keep clean and serve clean.
- Use portable water for cooking.
- Ensure pest control.

FOOD AND AGRICULTURE ORGANIZATION (FAO)'S PROGRAMME ON FOOD CONTROL :

Producing safe food supply is a prerequisite to successful domestic and international food trade and a key to sustainable development of national agricultural resources. All consumers have the right to expect and demand good-quality and safe food at affordable prices. An effective food control system must have the following fundamental components :

- **Laws and regulations** requiring sound hygienic practices along the food chain, the establishment of food standards, safe use of food additives and pesticides and informative labeling.
- ***Inspection and analysis*** with adequate food laboratories and other facilities.
- ***Certification and reporting*** to give the producer and the purchaser confidence in the food control system.
- ***Information*** and education on proper food handling and storage.
- ***Quality control*** to provide consumers with good-quality and safe foods.
- ***Co-operation*** among food producers, processor and handlers.

SAFETY OF SEA-FOODS :

The seafood industry is a commercial food sector in which traceability is becoming a legal and commercial necessity[3]. Globalization of trade and the lack of international standards have made identifying the origin and history of seafood products difficult, raising concerns about the safety of their seafood supplies. Basically, a traceability system must be able to trace both the products and activities. This requires a system capable of (1) tracing products through the distribution chain, (2) providing information on product ingredients, and (3) understanding and communicating the effects of production practices and distribution on product quality and safety.

Some nations have already passed legislation requiring comprehensive labelling and, in some instances, complete traceability of all food products.

Software designers have started developing software capable of tracking seafood from "fish to dish". Advances in IT have made knowledge management and data transfer affordable, reliable, and efficient. For example, the ERP (Enterprise Resource Planning) software is primarily designed to track products in lots or sub-lots through food processing including tracking of additional ingredients, portioning, and transformation.

FISH AND FISHERY PRODUCTS :

Adoption of the agenda under FAO in the 22nd Session of the Codex committee :

1. Certification of fishery products.
2. Method of analysis for fish and fishery products (Determination of Salt Content in Salted Fish and Dried Salted Fish, Estimation of Proportion of Fish Fillet and Minced Fish Flesh, Determination of Net Weight of Products)
3. Food additives in fish and fishery products.
4. Inclusion of additional species in fish standards
5. Definition of predatory species of fish to which the higher level of methyl-mercury applies.

SAFETY OF EDIBLE POULTRY TISSUES[4] :

The use of veterinary antibiotics is an important tool for treatment of diseases in poultry. However, misuse of these antibiotics can create anti-microbial residues in edible animal tissues exceeding the FDA established safety tolerances. To ensure safety of the food supply, the foods, including poultry, are monitored for illegal residues. Technological advances and mass production in poultry-processing present new challenges for providing microbiologically safe product.

MILK, CHEESE AND DAIRY PRODUCTS :

At least two different approaches should be evaluated[5] :

1. Mandatory pasteurization;
2. A combination of other safety approaches such as mandatory technical and safety training for cheese-makers, implementation of an approved risk-reduction program, and finished product testing for pathogens.

REGULATION OF CHEMICALS AND RESIDUES IN FOOD :

In Australia and New Zealand, for instance, the Federation of *Australia New Zealand Food Standards* in the regulation of agriculture and veterinary chemicals acts to protect public health and safety by ensuring safety limits of potential residues in food. Before an agricultural or veterinary chemical is registered, the *Agricultural and Veterinary Chemicals Code Act 1994* requires it to be satisfied that there will not be any appreciable risk to the consumer, to the person handling, applying or administering the chemical, to the environment, to the target crop or animal or to trade in an agricultural commodity.

WATER ADMINISTRATION :

Water's relation to human health, environment and economic development involves individuals and governments at all leveles. For example, in Canada, Public Safety and Emergency Preparedness Canada (PSEPC) is the new federal department interested in these types of issues[6]. PSEPC's interest in water issues include :

- Critical infrastructure protection.
- Critical infrastructure relations with the U.S.
- Emergency management
- Disaster Financial Assistance Arrangements (DFAA)
- Mitigation.

ROLE OF TRANSGENIC CROPS :

Open field trials of GMOs would contaminate global environment forever, destroy food sovereignty and biodiversity. Genetically modified crops should not remain untested so as not to risk the bio-safety of our planet.

FOOD SAFETY IN DEVELOPING COUNTRIES :

It is based on the following major steps :

- Development of national strategies to improve food quality and consumer protection.
- Advice on legislation related to food quality control
- Training and human resources development
- Improving export food inspection and international trade.

SUMMARY AND CONCLUSION :

The entire issue regarding food safety should be implemented efficiently with proper concern towards overall improvement in all related sectors, namely, laboratory facilities, proper agricultural, irrigation and sanitation systems, pollution control strategies, and, above all, food quality inspection, monitoring and management including proper treatment, packaging and preservation of foods. The establishment of sanitary standards should facilitate trade by assuring importers that the food they import is of an acceptable standard. At the same time it should guide exporters as to the expectations of importers concerning food quality and safety. The alarming revelation about the pesticide residue far in excess of the permissible limits in the bottled water industry should be an eye opener to the processed food industries in developing countries like India.

The foods and beverage sector in highly vulnerable to food-borne diseases caused by micro organisms-bacteria, moulds, intestinal worms or microscopic protozoa, or virus that can only replicate in a host, that should be judiciously handled to improve the quality of foods by making them free of contamination. In many developing countries, a wide variety of raw, cooked, semi-processed, hot and cold foods and beverages are sold by itinerant pedlars or from open-air food stalls. The local authorities have to be supported to improve infrastructure (e.g. provision of portable water, garbage disposal facilities and areas for personal hygiene of vendors), strengthening official control over the quality and safety of street foods and training food handlers in basic hygienic practices. Developing countries should be assisted in formulating appropriate legislation and setting up regulatory bodies for all aspects of bio-safety aiming at enchancing global food security and improving living standards for all.

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BRIQUETTING OF BIOMASS

Kavita Dubey, Vijay Kumar Upadhyay and Arun Pandey*

Briquetting is the process of conversion of loose, high volume, low density mass to compact, low volume and high density lumps by compression. Briquettes can be produced with a density of 1.2 g/cm^3 from loose biomass of bulk density 0.1 to 0.2 g /cm^3. These can be burnt clean and therefore, are eco-friendly.

Many of the developing countries produce huge quantities of agro residues but they are used inefficiently causing extensive pollution to the environment. The major residues are rice husk, coffee husk, coir pith, jute sticks, bagasse, groundnut shells, mustard stalks and cotton stalks. Sawdust, a milling residue is also available in huge quantity. Apart from the problems of transportation, storage, and handling, the direct burning of loose biomass in conventional grates is associated with very low thermal efficiency and widespread air pollution. The conversion efficiencies are as low as 40% with particulate emissions in the flue gases in excess of 3000 mg/Nm^3. In addition, a large percentage of unburnt carbonaceous ash has to be disposed of. In the case of rice husk, this amounts to more than 40% of the feed burnt. As a typical example, about 800 tonnes of rice husk ash are generated every day in Ludhiana (Punjab) as a result of burning 2000 tonnes of husk. Briquetting of the husk could mitigate these pollution problems while, at the same time, making use of this important industrial/domestic energy resource. Briquetting technology is yet to get a strong foothold in many developing countries because of technical constraints involved and the lack of knowledge to adapt the technology to suit local conditions. Overcoming the many operational problems associated with this technology and ensuring the quality of the raw material used are crucial factors in determining its commercial success. In addition to this commercial aspect, the importance of this technology lies in conserving wood, a commodity extensively used in developing countries and leading to the widespread destruction of forests.

Biomass densification, which is also known as briquetting of sawdust and other agro residues, has been practiced for many years in several countries. With a view to improving the briquetting scene in India, the Indian Renewable Energy Development Agency (IREDA) - a finance granting agency - has sponsored many briquetting projects, all of which are using piston presses for briquetting purposes. Yet the fact remains that these are not being used efficiently because of their technical flaws and also due to a lack of understanding of biomass characteristics. Holding meetings with entrepreneurs at different levels, providing technical back-up shells and educating entrepreneurs have, to some extent, helped some plants to achieve profitability and this holds out hope of reviving the briquetting sector. The recent successes in briquetting technology and the growing number of entrepreneurs in the briquetting sector, are evidence that biomass

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briquetting will emerge as a promising option for the new entrepreneurs and other users of biomass.

POTENTIAL AGRO-RESIDUES AND THEIR CHARACTERISTICS

The potential agro-residues which do not pose collection and drying problems normally associated with biomass are rice husk, groundnut shells, coffee husk and coir waste (obtained by dry process). At present, loose rice husk, groundnut shells and other agro-residues are being used mostly by small scale boilers in process industries. Apart from being inefficient, these boilers do not have provision to capture fly ash and unburnt carbon, with the result that extensive air pollution is being created. in Ludhiana, one of the industrialized cities of Punjab (India), about 2,000 tonnes of rice husk is burnt every day. This pollution problem has become so acute that the State Government of Punjab has banned the burning of loose husk in such boilers. It is very likely that other States in India will soon follow this policy. The users have been advised to use husk either as briquetted fuel or in fluidized bed boilers with proper pollution control measures. As the number of industries is growing day by day, the energy required is also increasing proportionately and the present power supply is unable to meet the energy demand. To combat this energy shortage, developed as well as developing countries are putting more efforts into R&D to tap alternative energy sources. State policies are also being formulated to encourage alternative sources of energy. In India alone, it is proposed that 17,000 MW should be produced from biomass. Although other options like gasification can be used for power generation, briquetting of biomass can be considered for its economics, reliability and ease of operation. Briquettes of small size can be used in gasifies for power generation. If the plant sites are chosen properly for easy availability of raw material, the agro-residues can be briquetted to reduce further transportation costs and associated pollution. This also improves the handling characteristics of biomass. The briquettes so obtained are very good fuels for local small scale industries and domestic purposes. The basic use can be to substitute wood and coal thereby conserving natural wealth.

APPROPRIATE BIOMASS RESIDUES FOR BRIQUETTING

There are many factors to consider before a biomass qualifies for use as feedstock for briquetting. Apart from its availability in large quantities, it should have some desirable characteristics. First, the moisture content should be as low as possible, generally in the range of 10-15 percent. High moisture content will pose problems in grinding and excessive energy will be required for drying. Second, biomass residues normally have much lower ash content (except for rice husk with 20% ash) but their ashes have a higher percentage of alkaline minerals, especially potash. These constituents have a tendency to devolatalise during combustion and condense on tubes, especially those of super heaters. These constituents also lower the sintering temperature of ash, leading to ash deposition on the boiler's exposed surfaces. Therefore alkaline materials should be low.

TYPICAL BRIQUETTE CHARACTERSTICS

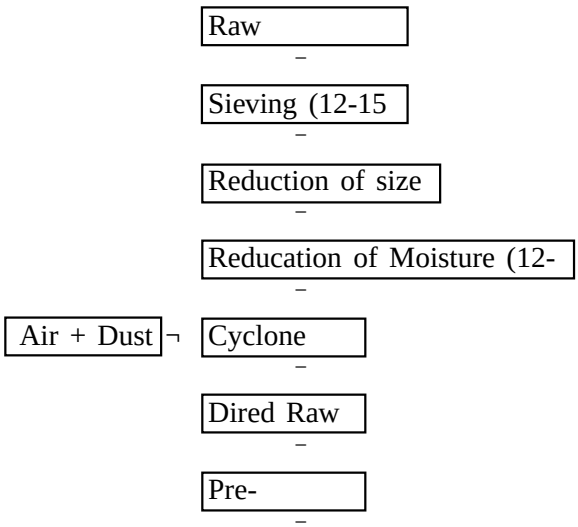
- Appearance : Grayish white / brown
- Nature : Cellulose, eco- friendly
- Bulk density : 1100 Kg / meter cube
- Carbon : 40 – 42 % by weight
- Hydrogen : 3 %
- Sulphur : Nil
- Moisture : Less than 5 %
- Calorific value : 3800 – 4000 Kcal / Kg
- Ash : 5 – 8 %

GENERALLY BIOMASS BRIQUETTES ARE MARKETED IN THREE GRADES

- **Grade A-** void of cracks, hard with metallic sound when rolled and lengthy (with 390 mm in length)
- **Grade B-** with minimum cracks , hard and not less than 75 mm in length.
- **Grade C-** as "B" except the length is not less than 50 mm in length.

TECHNOLOGY USED IN BRIQUETTING PLANT

At present two main high pressure technologies, ram or piston press and screw extrusion machines, are used for briquetting. While the briquettes produced by a piston press are completely solid, screw press briquettes on the other hand have a concentric hole which gives better combustion characteristics due to a larger specific area. The screw press briquettes are also homogeneous and do not disintegrate easily. Having a high combustion rate, these can substitute for coal in most applications and in boilers. Briquettes can be produced with a density of 1.2 g/cm³ from loose biomass of bulk density 0.1 to 0.2 g /cm³ These can be burnt clean and therefore are eco-friendly arid also those advantages that are associated with the use of biomass are present in the briquettes.



Flow diagram for making Briquettes

APPLIANCES FOR BIOMASS BRIQUETTES

Briquettes can be used in any appliances meant for burning wood or coal. However, certain changes in operating parameters especially regarding the distribution of primary and secondary air will have to be incorporated into the conversion. One should first understand the specific characteristics of briquetted biomass before taking steps to make changes in appliances. Briquettes have a density twice that of common fuel wood. Porosity is very low and, accordingly, char produced during combustion is denser than wood or biomass charcoal. Moreover, screw pressed briquettes with a central hole have better combustibility than ram pressed solid briquettes and are considered to be better fuel than coal, wood and solid briquettes. This is mainly due to the larger surface area per unit weight or volume for the same size. In spite of low porosity the effective thickness or resistance for release of volatiles is relatively much less and thus their flammability is much higher. Finally, the char left after combustion is also twice as dense as wood and it burns slowly due to higher ash content. Since inventory of this char is much higher for the same thickness of bed, the briquettes have a higher heat capacity i.e., they retain heat for a longer period and keep the appliance at a higher temperature which then facilitates easy ignition of fresh fuel charges. Briquettes can be used in the following :

- Boilers : For steam generation.

- Food Processing Industries : Distilleries, Bakeries canteens, resturants etc.
- Textile Process Houses : Dyeing , bleaching etc.
- Agro Products : Tobacco curing , oil milling, tea curing etc
- Clay Products **:** Brick kilns , tile making, pot firing etc.
- Domestic Purposes : Cooking, water, heating etc.
- Gasification **:** Fuel in gasifies.

ADVANTAGES OF USE OF BRIQUETTES :

- Briquettes are cheaper than coal.
- High sulfur content of oil and coal, when burnt, pollutes the environment. There is no sulfur in briquettes.
- Biomass briquettes have a higher practical thermal value and much lower ash content (2-10% as compared to 20-40% in coal)
- There is no fly ash when burning briquettes.
- Consistent qualities, have high burning efficiency, and are ideally sized for complete combustion.
- Combustion is more uniform compared to coal.
- Produced near the consumption centers and supplies do not depend on erratic transport on long journeys.
- Biomass briquettes are non-conventional source of energy, renewable in nature, eco-friendly, non-polluting & economical.

DISADVANTAGES :

- Briquettes cannot withstand direct contact with water and require covered storage facility.
- Maximum attainable temperature is 1000 C due to lower carbon content.
- Burning capacity of furnace per unit volume is low as compared to coal.
- Round the year availability is not assured.

ORGANIZATIONS INVOLVED IN DEVELOPMENT OF BRIQUETTES

The following organizations have been invalided :

- IREDA has funded many briquetting projects.
- Indian Institute of Technology, New Delhi, sponsored by University of Twente, Netherland.
- Indian Institute of Technology, Bangalore, gasification of briquettes – DESI Power Ltd. Rice husk in the state of Bihar.
- Appropriate Rural Technology Institute, Pune – Briquettes from sugarcane.
- Tata Energy Research Institute (TERI)

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SHORT COMMUNICATION

CLOUDBURST DISASTER AND ITS MANAGEMENT WITH SPECIAL REFERENCE TO INDIAN SUBCONTINENT

Devananda Beura

Cloudburst is an extreme climatic process involving intense rainfall and serve flood. It becomes disastrous with heavy loss of lives and properties within a short period of time. There is no prediction system developed yet to tackle this disaster. The article discusses precisely the nature, cause and the management aspects of cloudburst disaster.

INTRODUCTION

The world is passing through severe episodes of climatic change. The global climatic change has enhanced the arrival of different disasters. Day by day some climatic processes are becoming extreme in their nature and emerging as new disasters. Even though some of them exist elsewhere in the earth but not happening in our locality, we are unaware of those disasters. One decade back there was hardly any familiarity with disasters like heat stroke and tsunami in India. Similarly, another climatic hazard has become so uttered during these days i.e. the cloudburst. On 5th and 6th August 2010, a cloudburst occurred in Leh town of Jammu and Kashmir comprising extreme rainfall and severe flood, which devastated the entire region. Along with heavy loss of property about 175 people died and 400 people were found missing in this disaster. The major damage had been done by the cloudburst-induced flash flood. Similar flash flood occurred on 26th July 2005 in Mumbai due to cloudburst and washed away many lives and livelihood of Mumbai people.

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WHAT IS CLOUDBURST ?

Cloudburst is a type of rainfall that constitutes extreme or severe shower. It is a weather phenomenon of sudden and violent nature. It continue for a very short period of time and is confined to a small geographical area. Sometimes the aggressive rainfall takes the shape of rainstorm associated with hail and thunder. Most often cloudburst occurs in desert and mountainous regions. However, interior regions of continental landmasses rarely and irregularly receive the cloudburst. Accordingly to meteorologists, the rate of rainfall in a cloudburst is equal to or greater than 100 mm or 4.94 inches per hour. During a cloudburst, within a few minutes of time the affected area receives more than 2 cm of rainfall. Regarding the cloudburst, a common belief existed in early days that clouds were solid masses full of water and poured heavily due to their bursting. But in real sense cloudburst doesn't occur in that way.

Cloudburst involves heavy rainfall for which it can be disastrous when continued for a long span of time. It creates flash flood in the concerned area. The devastation gets enhanced by the combined action of extreme rainfall and heavy flooding.

CAUSE OF CLOUD BURST

In India, cloudbursts occur normally in rainy days, particularly in the month of July and August. Monsoon cloud from the Bay of Bengal reaches the Himalayas by moving across the Ganges plains. The monsoon strikes against the mountains and rushes upward by the air currents in a rainstorm formed locally. This process facilities rapid condensation of clouds. But, sometimes at this stage it fails to rain, which may be due to blowing of very warm current of air under the rain cloud. Strong current of rising air protects the raindrops to fall down. As a result, the process avails a good length of time and the cloud gets overloaded with rain. When the air current abruptly stops moving, the heavy water drops fall down forcefully on the surface. This climatic phenomenon is known as cloudburst. As the cloudbursts fall from a very high altitude, it happens to be so strong.

Generally, extremely high cumulonimbus clouds realize the cloudbrust. In a cloudburst small drops are fused together to form large drops and fall down fast as water pour on surface. Such an event causing the cloudburst is known as Langmuir precipitation.

PAST RECORDS

Cloudbrust occurs in many parts of the world. In India, though it is not restricted to a particular area, but most often happens in north and north eastern regions. The damage and death toll depends upon the area of occurence and intensity of rainfall and flood. Some of the major cloudbursts of deadly nature in India have been given in the table-1.

Table 1 : Record of Major Cloudbursts in India

Year	Place	Casualities
31st August, 1960	Mandi and Suketi valley of Himachal Pradesh	103 People were killed
July, 1970	Upper catchment area Alaknanda, Badrinath to Haridwar	Entire village was swept away
15th August 1997	Chirgaon in Shimla district, Himachal Pradesh	115 people were killed
17th August, 1998	Malpa village in Kali of Kumaon	250 people were killed
July, 2002	Marwari, Kotsisham, Matgoan and Agonda of Uttaranchal	28 people were killed
16th July 2003	Shilagarh in Gursa area of Kullu, Himachal Pradesh	40 people were killed
6th July 2004	Badrinath shrine area Chamoli district of Uttaranchal	17 people were killed
26th July 2005	Mumbai	500 people were killed
16th August 2007	Bhavi village in Ghanvi, Himachal Pradesh	52 people were killed
7th August 2009	Nachni near Munshiyari in Pithoragatrh district of Uttarakhand	38 people were killed
6th August 2010	Leh town in Jammu and Kashmir	175 people were killed

DISASTER MANAGEMENT

Clouburst becomes disastrous due to heavy rain and severe flood thereof. Because cloudburst is a sudden climatic process, it is not possible to predict before it breaks out. There is no such system developed yet to predict the cloudburst disaster. The very initial stage of disaster management 'the Diasaster Prediction System (DPS)' is not

supportive to the further course of action. Therefore, the Disaster Warning System (DWS) and Public Communication System (PCS) as downstream measures are ineffective. People may not be able to keep them prepared for the consequences in cloudburst disaster. Also, 'it will be difficult' to evaulate to evacuate from the vulnerable places in apprehension to the flash flood. Predisaster management in cloudburst is handicapped in dealing with the precautionary measures. In this regard, post disaster management is more effective and optimum care should be taken in implementing the action plans outlined therein. Both rescue and relief operations are to be undertaken on warfooting basis. During the sudden flood, particularly in hilly areas, there is always heavy siltation and mudflow. It is very difficult to rescue the lives and property from the mudflow. Severe rainfall and flood cut off the physical communications in the area. Hence, relief operation appears to be challenging as the relief team has to pass through strong currents of rivers and streams. With proper infrastructural readiness these two important operations can be undertaken successfully. The cloudburst may effectively be tacked in the post disaster management or long term management in frequently occuring areas. Rehabilitation, restructing and regain of normalcy in distress should be the immediate tasks after rain and flood. Under the long term management scheme, desiltation programme in all the rivers and streams is to be taken up regularly to make their carrying capacity more efficient. Highly slopy areas are prone to landslide and soil erosion. Such areas are prohibited from new structures and protective measures should be taken for the existing ones. While planning for new roads, bridges and river valley projects, detailed evaluation of feasibility should be taken into account.

CONCLUSION

The world is witnessing the rise in number and intensity of earth and climatic processes. Many of them are designated as disasters because of their furious nature of occurrences. Cloudburst is such a climatic process that continues for a short period with high magnitude of devastation. The real havoc occurs due to flash flood, mud flow and land slides in a cloudburst disaster. As there cannot be any prediction system for his disaster, the sufferings become extreme without a predisaster prepareness. It is not at all possible to stop the natural disasters like this, but with incorporation of effective management principles in the course of tackling can anul the adversity. Degree of devastation in continuously affected areas may be reduced sustantially by all time disaster preparedness and awareness programme.

MAJOR RECOMMENDATIONS

Emanating from the

97th INDIAN SCIENCE CONGRESS

RECOMMENDATIONS FROM THE ADDRESS OF THE HON'BLE PRIME MINISTER DR. MANMOHAN SINGH

"LIBERATE SCIENCE FROM SHACKLES OF BUREAUCRATISM"

1. India must chalk out strategies to achieve greater energy efficiency and a shift to renewable energy. We should plan to be among the leaders in the development of science and technology related to mitigation and also adaptation and market it to the whole world. We must plan for an accelerated nuclear power development programme.
2. It was decided to launch a Jawaharlal Nehru National Solar Mission for establishment of 20,000 MW of solar generation capacity by 2020, which provides an opportunity to the indigenous scientific institutions to contribute.
3. Water resource management is a very important area since per capita availability of water is declining as population has increased. The Ministry of Science and Technology has initiated a Technology Mission for Winning, Augmentation and Renovation (WAR) of water.
4. Strengthening food security through scientific efforts like better weather forecasting for agricultural management, Geo-spatial Technology Applications Mission to provide crop planning and monitoring as well as flood management. Developments in biotechnology present us the prospect of improving yields in our major crops by increasing resistance to pests and also to moisture stress.
5. Providing affordable health care and improving the quality of life of the elderly is another major challenge of the 21st century. We must build our scientific capabilities in a way that they can respond in real time to problems such as pandemics.
6. Revision of the value of doctoral and post-doctoral fellowships as well as the formulation of schemes that would cover all research scholars with some funding support in order to make science education outreach inclusive and affordable.
7. Redouble our efforts to attract many more talented young women to take up careers in science. A step in this direction is a new scheme available for women's universities named Consolidation of University Research, Innovation and Excellence (CURIE) which provides financial help for complete upgradation of facilities in such universities.
8. The National Science and Engineering Research Board to start functioning before March 2010. A National Policy for Data Sharing and Accessibility has been formulated. The Protection of Intellectual Property Bill, focused on sharing revenue from intellectual properties with researchers will be taken up soon.

9. Conversion of the "brain drain" of the past into a "brain gain" for the future - special effort to encourage scientists of Indian origin currently working abroad to return to India.
10. The decade 2010-2020 has been declared as the "Decade of Innovations". We need new solutions in many areas to achieve our goals of inclusive and sustainable growth - in healthcare, energy, urban infrastructure, water, and transportation, etc.,
11. The country must develop an Innovation Eco-system to stimulate innovations. Innovators must work in partnership with industry. We need to concentrate on strengthening the linkages between academia, research and industry.
12. Indian science should have a strong outward orientation; our science establishments should step up global alliances that will expose our scientists to the best in the world and enhance our competitiveness.

RECOMMENDATIONS FROM THE ADDRESS OF THE HON'BLE MINISTER OF STATE (INDEPENDENT CHARGE) FOR SCIENCE AND TECHNOLOGY AND EARTH SCIENCES; HON'BLE MINSTER OF STATE IN THE PRIME MINISTER'S OFFICE; PERSONNEL, PUBLIC GRIEVANCES AND PENSIONS AND PARLIAMENTARY AFFAIRS, SHRI PRITHVIRAJ CHAVAN

1. Acceleration of implementation of Innovation in Science Pursuit for Inspired Research (INSPIRE) launched by the Hon'ble Prime Minister in December 2008 in order to attract the best students to science.
2. Encourage re-entry programmes for women scientists and return of Indian Diaspora in order to fill the gap of faculty in higher education Institutions.
3. Traditional Knowledge Digital Library (TKDL) will not only protect our traditional knowledge but it will be used by the European Patent Office and the US Patent and Trade Organisation for prevention of grant of patents based on traditional Indian knowledge.
4. Establishment of a state of art "Tsunami Warning Centre", Ocean observation system, weather observation and modeling capabilities, and atmospheric physics modelling.
5. International Co-operation in the field of S&T of India has grown several fold. Technology focused initiatives like Science Bridges with UK have opened up new possibilities and mechanisms to forge Academy Industry alliances and partnerships.
6. It is widely believed that 21st century will belong to China and India on account of strength of their economies and human resources. Since the next wealth creation opportunity will undoubtedly depend on science, technology and innovation, a major challenge in 21st century will be in relating the knowledge to economic outcomes and ability of science and technology system to innovate at affordable costs.
7. The grand challenges ahead are is the area of Energy security, Food security, Water, Affordable Healthcare for all and Terrorism and Internal security.
8. There is congruence between the global concern for climate change and India's concern for energy security. Answers to both lie in building capacities for alternate energy sources like solar, wind and nuclear. Also, research on clean coal technology would remain crucial for the country.
9. To address the challenges of food security, geospatial data inputs for crop planning and

monitoring using special algorithms have been developed and made available to several states.

10. Science ministries have taken up several initiatives to address the challenge of water security. A Technology Mission on "Winning, Augmentation and Renovation" (WAR) for Water has been mounted by the Department of Science and Technology.
11. The Indian S&T sector should gear itself to engage in the research dimensions of National Action Plan on Climate Change (NAPCC).
12. In the area of affordable health care for all, CSIR has mounted Open Source Drug Discovery (OSDD) for infectious diseases with global participation which has identified new molecular entities for a number of therapeutic targets.
13. A "Decade of Innovations" has been articulated as the National policy. The Indian R&D sector should gear itself to fulfill the promise and deliver ***innovative technology*** solutions rather than ***technologies.***
14. There is a need to develop a suitable Science, Technology and Innovation policy framework in order to get a favorable position in global assessment of innovation industry.
15. At the end of the eleventh plan, India might need a strategy to assess and measure the economic impact of R&D and technology-led GDP growth and prepare a road map for adequate investments into the Science, Technology and Innovation during the Twelfth Plan.
16. Our future strategy should serve to:
    (a) Enhance synergy among academy, research and industry
    (b) Build new strategies for development of private-public partnerships in R&D and
    (c) Step-up global alliances developed during the Eleventh Plan and
    (d) Aim at acceleration of the pace of conversion of scientific outputs to targeted socio-economic and developmental outcomes.

RECOMMENDATIONS FROM THE PRESIDENTIAL ADDRESS OF DR. G. MADHAVAN NAIR, GENERAL PRESIDENT, INDIAN SCIENCE CONGRESS ASSOCIATION 2009 - 2010

1. With the available scientific manpower in the country (which is the third largest in the world), the Indian Science and Technology (S&T) is bound to assume a significant role in rearing the status of the country to that of a developed nation by 2020.
2. Developments in the fields of agriculture, atomic energy, space research, Information technology, biotechnology etc., speak volumes about the capabilities of the Indian scientific community and can match international standards at all levels.
3. Enhancing agriculture productivity from 1.7 to at least 2 tonnes per hector in order to meet the requirements of the people by year 2020.
4. There is a strong need for developing alternate sources of energy. Improving the quality of generating energy from natural products is one of the challenges.
5. We need to device cost effective means to tap wind and solar energy and R&D efforts in these areas needs to be strengthened.
6. Nano-technology is yet another area which can contribute to revolutionize the future demands of agriculture, healthcare and high strength materials.
7. Emphasis on bio-science and geonome research which are going to revolutionize applications related to human health and

environment security. The research in this area can lead to major achievements including work on transgenic crops with disease resistant capabilities, nitrogen fixation and production of vaccine, enzymes and recombinant proteins.

8. Conceive application programmes in the area of information technology to model physical phenomena, chemical processes, bio evaluation, etc which demand lot of efforts from young scientists and IT professionals.
9. The monitoring of climate and environment is another major area of both national and global concern and needs to be addressed adequately.
10. Advances in Medical sciences and immunization are absolutely a major priority for the highly populous India, which has an ambitious quest in prevention, early diagnosis and treatment of various diseases that affect the population, particularly the poorer sections.
11. The innovation and challenges in technology required to solve the societal problems are quite complex and demanding. In addition to massive investment in terms of infrastructure, there is a strong need for the development and identification of scientific talents.
12. Kindling scientific spirit and explorative spirit in young minds also requires equally talented scientific communicators and teachers.
13. While encouraging the youngsters to pursue advanced research schemes, there is a need for creating a cadre of scientific managers.
14. There is a need to create proper facilities and environment for research in the universities in order to do innovative work at the cutting edge of S&T as the universities act as the prime movers of scientific research and serve as feeders to the specialized laboratories.
15. Need for interdisciplinary form of science education which allows free flow of knowledge and ideas that migrate from one area to another. Students and researchers must be taught to relate what is taught in classes with real life situations early enough, from their primary classes, so to speak.

RECOMMENDATIONS FROM PUBLIC LECTURES

Future of Science in India

Prof. CNR Rao said that science and technology should be treated as different subjects, where technology is simply the application of science. He urged to take up study of pure sciences. He pointed out that the status in science education in India is dismal even compared to other Asian developing countries like Japan, China and South Korea.

He remarked that the educational institutions should play a constructive role in promoting science studies and scientific research.

Keep your mind open to nature: Roger Tsien

The Nobel Laureate, Prof. Roger Tsien, in his public lecture at the 97th Indian Science congress, advised young students and researchers to keep their mind open to the beats of nature.

Prof Tsien is renowned for revolutionizing the fields of cell biology and neurobiology by allowing scientists to peer inside living cells and watch the behavior of molecules in real time.

Prof Tsien stressed on teamwork by mentioning the collaboration behind his Nobel Prize winning work.

It can be done : Dr. Kalam

Dr. Kalam in his public lecture said that Indian scientists should look forward to celebrate the socio-economic development of India in 2020. He then proposed his vision of transition of Indian Science from 2020 to 2050 saying that the vision for 2050 is one of dynamic growth.

Terming Science as borderless, Dr. Kalam put forth his visualization of Global Human Civilization for 2050.

In context of Indian perspective, he said proper water management, sustainable agriculture development using organic farming practices, energy consumption and sustainability, customized healthcare for promoting enhanced longevity, balancing the greenhouse gas budget and emergence of new global leaders focusing on multi-disciplinary action are some of the key points of his visualization. He added that scientists should start considering earth, moon and mars as an economic complex for future habitat expansion of human beings.

Demystifying the Large Hadron Collider: Mr. Atul Gurtu

Mr. Atul Gurtu of TIFR unraveled the mystery surrounding the Large Hadron Collider (LHC). The eminent physicist who is India's chief spokesman of the LHC said that LHC is hailed the mother of all experiments would usher in a new era of particle cosmology.

Mr. Gurtu explained about India's involvement in this mammoth experiment. LHC will attempt to simulate the birth of the Universe by colliding protons having near light speed in a tunnel of 27km in circumference. It also hopes to find the existence of the hypothetical "Gods particle" called Higgs Boson.

Dr. MGK Menon's talk explained about the birth of meson physics

RECOMMENDATIONS FROM CHILDREN SCIENCE CONGRESS

1. Children Science Congress (CSC) 2010 was organized from 4 – 6, January 2010, hosted by Indian Space Research Organization (ISRO) and University of Kerala, Thiruvananthapuram, with the objective to stimulate creativity and create interest in science in the young minds.
2. The Congress encourages children and teachers to visualize the future of the nation and to pursue their natural curiosity, thus unleashing a wave of creativity and scientific temper.
3. CSC provides a platform for children across the country to interact with eminent scientists and enhance their knowledge and ideas.
4. Dr G Madhavan Nair, General President, ISCA presided over the function. In his address, Dr Madhavan Nair stressed the "need to have passion for science cultivated from very young age". He exhorted the youngsters to pursue science, learn and observe the nature and thus solve the mysteries of science and thereby improve the quality of life of the fellow beings. He urged the students to derive inspiration from great scientists like Sir C.V Raman who were deeply committed to science.
5. Dr. A P J Abdul Kalam, former President of India inaugurated CSC – 2010 on January 4, 2010. In his inaugural address, Dr. Abdul Kalam said that Earth, which was rapidly exhausting its resources, would not remain an independent entity in the future, but form a 'single economic entity' with the Moon and Mars as a single economic and strategic entity. This will be possible by developing scientific knowledge in a very unique solution to the crisis of water, energy, infrastructure faced by humanity in different parts of the world. Detection of evidences of water on the Moon for the first time through the Chandrayaan-1 mission, ISRO had found an answer to an issue that was evading the collective scientific wisdom of all the space-faring nations for the last five decades. He urged the CSC delegates

to follow the example and use science to prove other impossible things possible.

EIGHT POINT OATH

1. Science is a lifetime mission. I will work, work and work and succeed.
2. Wherever I am, a thought will always come to my mind. That is what I can innovate, invent or discover.
3. I will always remember that "Let not my winged days, be spent in vain".
4. I realize I have to set a great scientific goal that will lead me to think high, work and persevere to realize the goal.
5. My greatest friends will be great scientific minds, great teachers and great books.
6. I firmly believe that no problem can defeat me; I will become the captain of the problem, defeat the problem and succeed.
7. I will work and work for removing the problems faced by planet earth in the areas of water, energy, habitat, waste management and environment through the application of science and technology.
8. My National Flag flies in my heart and I will bring glory to my nation.

RECOMMENDATIONS FROM SCIENCE COMMUNICATORS MEET (3RD VIGYAN SANCHARAK SAMMELAN)

3rd Vigyan Sancharak Sammelan (Science Communicators Meet) was organised during January 4-5, 2010 in concurrence with 97th Indian Science Congress (ISC 97) at Thiruvananthapuram, Kerala. This is a forum for science communicators and journalists to exchange their views, expertise and experience in the field of science communication through media, press etc., The focal theme of the sammelan was Advances in Science Journalism–Role of Space Science and Technology. This is the third in the series with the last two having been very successful.

Inaugural Session

In his inaugural address, Dr. G Madhavan Nair expressed the importance of Science Communication. He stressed that Science communicators should focus more on work within the laboratories where the real development of science is going on. He added that science communicators should convey the achievements of science to the common people. These days many awards are given to scientists, which indicates that the people have started recognizing the contribution and the significance of science.

In the presidential address, Prof A Jayakrishnan, Vice Chancellor, University of Kerala stressed upon the qualities of Science Communications.

General Sessions

There were five general sessions and one student session. Each session had a lead paper by the expertise followed by 5 - 6 presentations. The major topics covered under the general sessions were around the focal theme, *Advances in Science Journalism – Role of Space Science and Technology*. Overview of Satellite Communication, Need for Science Communication, Role of Space Science and Technology in Science Journalism, Science Communication and Emerging Challenges, Issues of Science Communication, Shortcomings in the present system, Recognitions of Science Journalism, Science Communication through various Media, Modern tools like Internet, Blogging, Online News etc., Importance of Space Technology, Contents of Science News, Trends in Science Journalism starting from ancient, medieval to modern era and Vision for the future Science Journalism etc.,. were discussed in detail.

Students' Session

The students' session chaired by the Head of Department, Communication and Journalism,

University of Kerala, as part of the science communicator's meet gave a good opportunity for the students to discuss on various topics connected with science/space journalism.

The Sammelan made the Following General Observations :

- Much of scientific knowledge is confined to a small minority of scientists. Regular science coverage in the media is absent and only occasional and sensational science news appears in print and electronic media.
- Science and technology journalism has progressively developing in India, in terms of quality and quantity, but is still far behind the desired level, (estimated around 3 % against a desired level of 15%.)
- Department of Science and Technology (DST) through Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad has supported the Vigyan Sancharak Sammelan thorugh the Indian Science Congress. The support is strongly recommended in future also since it has provided a platform for students, journalists and researchers to share their research. This inter-disciplinary field needs recognition by researchers in traditional areas of science. ISCA Chapter Conveners need to be continually sensitised about the theme and the selection process.

FOLLOWING RECOMMENDATIONS WERE CONSIDERED AND APPROVED AT THE PLENARY :

- Teacher educators have the potential to spread awareness and literacy among the next generation. Schemes to enhance their skills may be developed and introduced.
- Research scholars may be encouraged to give presentations about their research in third year to scholars from other disciplines. This would develop an appreciation about the research in other disciplines and would improve communication skills of the scholars. Universities can introduce this with internal resources.
- Plagiarism in science communication or in any type of serious communication should be avoided.
- Case studies elaborating research methodologies in science communication should be presented.
- Science communicators should be more committed and sincere about the news they disseminate; wrong or incomplete scientific information should not be communicated through that could mislead the viewer or reader. Proper checks and balances need to be provided by the science communicators through responsible journalistic principles.
- Developing countries should upload more than they download from the Internet. Social participation and successful local/regional development stories involving science and technology need to be brought to the forefront.
- Use of local language and idiom to reach larger populations is recommended.
- Students had put good efforts in their presentation. However, they need to concentrate on accuracy, brevity and language skills. It is suggested to continue the student session in future too; however, it was recommended to invite the science journalism students from all over the country.

3rd VSS was funded by DST through Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad and co-ordinated by Ms. Padmavathy A S, Scientist, ISRO.

RECOMMENDATIONS OF SECTIONAL COMMITTEES

Recommendations as Received from Sectional Presidents

AGRICULTURAL AND FORESTRY SCIENCES

Indian agriculture is facing the tremendous challenges of reduced farmers' income, water scarcity and labour shortage. Climate change has added another dimension to the already complex challenge. Problem of drought, flood, abrupt rise in temperature and events of heavy rainfall have intensified in recent years. To face these challenges, Indian agriculture has to be reoriented and rejuvenated. It needs to be diversified and made income-oriented for food and nutritional security of the emerging India. The following research and policy strategies need to be adopted for achieving the goal.

- **Climate change mitigation and adaptation :** Greenhouse gas emission from agriculture can be mitigated by adopting technologies such as growing aerobic, direct-seeded rice and use of nitrification inhibitors. Technologies such as conservation agriculture and crop diversification will be very useful for adaptation. Sequestration of carbon in soil would provide a good opportunity for climate change mitigation and adaptation. Government should promote these technologies and provide incentives to farmers adopting the same.
- **Crop improvement :** Crop cultivars for tolerance to biotic (pest and diseases) and abiotic (drought, flood, nutrient) stresses for different agro-climatic zones of the country using biotechnology and molecular tools should be developed. Recently developed flood tolerant (Swarna sub1, sub2) and drought resistance varieties should be promoted.
- **Crop management :** Conservation agriculture including the technologies of laser-aided land leveling and zero tillage is useful for increasing input-use efficiency. Alternate cropping and crop diversification (cereal-legume, agro-forestry, rice-fish culture) should be developed, refined and promoted in different agro-climatic zones.
- **Soil management :** Site-specific nutrient management using soil testing, remote sensing and GIS tools will be required for increasing crop yield and combating micronutrient deficiencies. Research on soil biotechnology and nanotechnology should be encouraged for enhancing nutrient use efficiency.
- **Water management :** Water scarcity is the biggest problem for the farmers. It is going to be more severe because of climate change. Promotion of water harvesting and water-saving technologies (drip and sprinkler, laser-aided land leveling, bed planting) should be given high priority.
- **Crop protection :** Technologies for identification and control of existing and emerging pests and diseases using molecular tools should be developed. Surveillance system and simulation models should be developed for forecasting pest outbreak and their timely control. Integrated pest management strategies should be promoted.
- **Promotion of new, unconventional crops :** High value, low volume crops including medicinal and essential oil bearing crops should be promoted. Some of these crops can be grown even in waste and marginal lands with minimum input and maximum income.
- **Micronutrient fortified crops :** For eradicating nutrient deficiencies and malnutrition, nutraceuticals should be developed introducing molecular tools and efficient management of micronutrients.

- **Utilization of agri-residues for energy :** Technologies should be developed for utilization of crop residues and agricultural wastes for energy generation. Efficient strains of crops such as sweet sorghum should be developed for bio-fuel.
- **Increasing research fund :** More funds should be allocated for agricultural research to address the problem faced by the farmers constituting 65% of Indian population.
- **Upgrading agricultural education :** Students and young researchers to be encouraged to take up agricultural research as their career through providing fellowship, research grants and more job opportunities.

ANIMAL, VETERINARY AND FISHERY SCIENCES

- With a view to conserve biodiversity emphasis on strengthening of Classical Zoology in the syllabus of under graduate (UG) and post graduate (PG) programmes be given, as it is not reflected in the new UGC syllabus.
- Bioresources are the wonderful gift of the nature to the mankind, whose sustainability can be effectively linked to rural livelihood and economic development, so science education should aim at attracting talent for proper management and sustainable utilization of bioresources.
- Ensuing dangers of climatic changes to biodiversity be recognized and mitigating measures be undertaken on priority.
- Premier institutions dealing with research on animals, veterinary and fishery should be linked academically for collaborative utilization and sharing infrastructure facilities, expertise and experience for bioprospecting the food security, rural development and economy.
- Programmes needed to be initiated for the exploration of other less known potential varieties of life forms with a view to ensure livelihood and food and financial safety.
- Multivoltine race of silkworm Bombyx mori should be tested under different agro climatic zones of India for proper evaluation of their improved efficiency.
- Through selective breeding, sex limited yellow colour cocoon can be achieved in silkworm breed M12W which will reduce the production cost of the fibre.
- Various disease problems in Aquaculture and their management measures are to be worked out in detail to ensure safety of highly nutritious food resources.
- Mangroves, important shelters of marine animals of high food values and source of livelihood of coastal people, should be declared as Natural Reserves. Interactive group should be established involving Animal Science, Fisheries, Agricultural Science (mainly Soil Science) to ensure Mangrove Conservation.
- Ecosystem approach should be used for holistic and sustainable development of Fisheries production.
- Application of molecular tools for wildlife (endangered species) conservation, and nanotechnological tools in rural health and livelihood be given importance.
- National funding agency should provide sufficient funding for research on Animal Taxonomy. Classical taxonomy has gone on backfoot during last 2 decades and proper identification of species of biodiversity importance has become a problem for young researchers.

- Biotechnological tools should be used for the conservation and management of habitats.
- Injudicious use of Pesticides affects the aquatic and terrestrial environment and animal resources. Efforts should be made through Public-Private partnership to mitigate these problems. Also eco-friendly remedial measures should be developed.
- 100% eradication of dengue causing Aedes mosquito is possible with the introduction of zooplankton, cyclopoid copepods. Its utilization can be introduced with some precaution. Culture of Makhana (a wetland cash crop which increases zooplankton density) be encouraged which can be utilized for freshwater culture in the wetlands of Bihar.
- Ecological and Molecular Parasitology of Helminths should be incorporated in the university curriculum and researchers should be encouraged to take up research in the frontier areas of Helminthology.
- New tools in molecular endocrinology should be applied to activate the specific resistant genes so as to combat the changing scenario of climate for aquaculture boost.

EARTH SYSTEM SCIENCES

- Reorganization of India's Earth Sciences institutions is needed.
- India, process of geophysical surveys has to be enhanced substantially.
- Mineralization potential of the Deccan Trap and Himalayan belt needs very serious reassessment.
- India's Uranium potential needs reassessment of intensive exploration. The meeting enclosed with vote of thanks the chair.

ENGINEERING SCIENCES

- Green technology should be encouraged. Program on harnessing of solar energy should gather more momentum on priority basis.
- System should design and encourage modern comfortable Public Transport system.
- Energy efficient technology has to be developed. Emphasis must be given to the design of devices which will reduce energy consumption yet be efficiently functional to do a given job.
- Outsourcing concept should be phased out step by step with genuine assessment of the actual requirements.
- Adequate attention has to be paid on the Scientific Storage system of food grains and edible. Mere increase in production of agricultural items cannot go on increasing because of the shrinking of agricultural land due to industrialization.
- Awareness should be created to discourage wastage of resources like electricity and water encourage the culture of cleanliness of ambience. Emphasis should be given on the culture of Waste management. This is important not only for aesthetic cause but also for economic benefit.
- Science & Engineering community have contributed more than other professionals but paradoxically the contributions of the real Scientists and Engineers are not visible in the society due to lack of due recognition. And that is why Young students are now-a-days opting for subjects devoid of science and Engineering to build up career. Mere distribution of few fellowships will not solve the problem unless the science and engineering profession is respected socially.

ENVIRONMENTAL SCIENCES

- It has been realized that different institutions should come together and a system be received to share the knowledge.
- On each subject area, concerned Central and State Government Department should make position to receive findings of various researchers and utilize them appropriately.

INFORMATION AND COMMUNICATION SCIENCE AND TECHNOLOGY (INCLUDING COMPUTER SCIENCES)

- Focus of ICT should be switched to mobile phone technology so as to widen up the scope of the field and make it reachable for common men. More and more applications related to mobile concepts should be encouraged.
- Thrust on research to be aligned with the millennium challenges for solving the 'famous' unsolved problems.
- The scope of science should be cinemascoped so as to reach everybody. The popularity generating outlook should be expanded to cover the non-science community of the country.
- Sectional programs should be more centric towards the applicability and sustainability of the subject.
- Plenary sessions may be well publicized to the local people, specially in the academic and industrial communities.
- Research scholars have to be given a special platform with a view to generate more inter-disciplinary interest to be nurtured.
- A separate track for the presentation of research scholars who have recently (in the last one year) submitted their Ph.D. thesis selected through a review process.
- An award also could be given to best Ph.D. thesis.

MATERIALS SCIENCE

- Materials Science community must reorganize its resources, manpower and focus on development of materials for energy (traditional and alternative), health (drug delivery, prosthesis, body-implants), green technology (environment, structure, effluent treatment) and efficient use of the natural resources (coal, minerals, water). A national level initiative is absolutely essential to harness solar, wind and atomic energy and develop commercially viable and portable devices (photovoltaic and fuel cells). A similar effort is also required to develop a policy document for production of key engineering materials like steel, cement, petroleum, rayon, fibre, etc.
- While funding for new or novel material development (synthesis and characterization) is needed, unambiguous focus and commitment on the true scope of application, realistic prediction of feasibility and success (milestones, targets), and well defined targets and deliverables with quantifiable index are essential for achieving breakthroughs in Materials Science and Technology.
- Reallocation of funds and manpower is desired to boost research to above threshold level and achieve landmark success (plant, product, machine, device) in material and technology development in key (automobile, micro-electronic, sensor) and strategic (energy, space, defence, water) sectors.
- While applied research will bring accountability, fundamental research should not be ignored but pursued in centres of excellence of proven credentials.
- Research in Materials Science and Technology must receive a boost with larger number of fellowships, research projects, pilot plant level (start up) grants, and incentives for mentors

or supervisors. Number of doctorates in India is far too low in India than that in China, Japan or USA. The country also faces an acute shortage of technical manpower to run sophisticated equipments, processors, devices and facilities. We should extend grants and encouragements to private institutions with proven credentials and should not be confined only to Government Institutions. Above all, appointment of fresh and young scientists and engineers should be promoted instead of ad-hoc appointments of retired personnel.

- Sponsored projects must be properly and routinely monitored and evaluated. Continuation must be linked to transparent and objective assessment in reasonable intervals.
- Characterization and testing of materials is a major bottleneck for larger participation of research community in high-end and strategic areas of research. Sophisticated equipments, gadgets or facilities are prohibitively expensive both in terms of capital investment and maintenance. As a results, these privileges lie only with large and major institutions (IISc, IITs, Central Universities and National Laboratories), and that too, only to certain groups and individuals. For larger participation and contributions from the entire research community, we need to create central and regional centres for characterization and testing of materials and components. These facilities must be manned by trained and paid technicians and not scientists with active career interests. The users must pay booking charges and the equipments must be run, manned and maintained from such booking charges. The Regional Instrumentation Centres created in the past were mooted with this very objective, but they have failed to live up to the desired level. The Government must take a fresh look at this problem.
- Indiscriminate proliferation of institutes and courses in the garb of advanced materials, nano-technology or materials science should not be allowed, Instead, a nation wide exercise is needed to develop a common curriculum on Materials Science and Engineering with room for specialization through electives and minor subjects so that both traditional sectors like steel, aerospace, plastics and semiconductors, as well as advanced areas like nanotechnology, bio-technology or energy science can be equally addressed and served.
- Career in Materials Science and Technology should be as attractive as that in banking, finance and information technology areas so that the best students willing to pursue career in Materials Science do not leave their academic pursuit or research career prematurely or in between.
- The key components or challenges that the materials community should immediately address in right earnestness are solar and fuel cells, sensors, light weight composites, auto grade steels, advanced ceramics, etc.

MATHEMATICAL SCIENCES (INCLUDING STATISTICS)

- Because of better facilities and no retirement age a large number of Indian Mathematicians is settled abroad. The credit of their research contributions goes to other countries and not to India. This is not good in the national perspective. To curb this menace the following are suggested.

  (a) As at the entry level NET clearance is required, similarly at the age of 55-66, there should be a national level screening and based on the academic record one should be granted further extension irrespective of the affiliation (Universities/ central universities/IITs).

(b) To prevent senior mathematicians from settling abroad, Research Professorships with reduce teaching load should be created. This will also benefit the young researchers as their supervisors will be able to give more time to them.

- Clearance of at least two advance courses after M.Sc. (Called Pre-Ph.D. courses) and at least two publications in refereed journals should be made mandatory for the submission of the Ph.D. thesis.
- The infrastructure facilities, expertise and experience available at mathematics research centers like TIFR, Mumbai, MATSCIENCE, Chennai and HRI, Allahabad should be shared and utilized by a wider section of the mathematics community. For this sabbatical leave rules should be liberalized.
- Industry/Government should provide more research opportunities to attract the young talents.
  - Steps (such as training from primary level) should be taken to improve the performance of the Indian team in the International Mathematics Olympiad.
- In the CSIR-UGC NET scheme for JRF and Lectureship 'Statistics' is made a part of 'Mathematical Sciences', while 'Computer Science and Applications' enjoys independent stature. In the question papers there are more questions form mathematics and very few questions from statistics. There is a lot of freedom of choice for the students with basic degree in mathematics but NOT for those who have degrees in Statistics. It is therefore recommended that as in the UPSC list of subjects for Civil Services Examination where statistics and mathematics figure as different subjects, similarly in the JRF and Lectureship Mathematics and Statistics should be considered as two different subjects.
- Ramanujan Birthday (December 22) should be declared as a "National Mathematics Day" programmes like seminars, paper presentations, quiz competitions should be held in all Mathematics Research Institutes/ Universities/Colleges on this day.

MEDICAL SCIENCES (INCLUDING PHYSIOLOGY)

- More emphasis on Research on Basic Medical Sciences
- Improvement of science by Public Private Partnership (PPP) model and setting of uniform rules & controlling body.
- Accommodate and acclimatization of impact of Globalization issue on health sector.
- Stoppage of Medical Scientist migration and encourage the persons who has been migrated to come back i.e., brain drain to brain gain.
- Evidence based learning – provisions & budgetary allocations.
- To gain trust towards a torture free world.

NEW BIOLOGY (INCLUDING BIO-CHEMISTRY, BIOPHYSICS & MOLECULAR BIOLOGY AND BIOTECHNOLOGY)

- Launch New Biology Initiative to
  1. Accelerate the growth of the New Biology
  2. Achieve solutions to societal challenges in food, energy, environment, and health
- Develop interdisciplinary curricula, graduate training and educator training to create and support New Biology
- Develop the information sciences and technologies that will be critical to the success of the New Biology
- Develop Entrepreneurs by
  1. setting up more technology incubators in universities and research institutions

2. encouraging partnership with industry
3. setting up funds at state level to support and nurture new ideas for commercialization for societal benefit

PHYSICAL SCIENCES

- It was resolved that the National sensor laboratory may be established, especially in under developed areas of the country (e.g. Bihar), as the work on different sensors is reported from the various physics departments of Universities in Bihar.
- The number of young scientist prizes and poster awards may be increased.
- Steps should be taken to attract good students for graduate and postgraduate courses in Physics.

PLANT SCIENCES

- Priority should be given to document the plant wealth of the Hot Spots of the Country.
- Documentation of Indigenous knowledge and use of Botanicals, their validation and value addition for shaping them into medicines should be given emphasis so as to make plant sciences much more attractive and valuable to the Society. Interface between Biotechnology, Molecular Biology and Pharmacology can be created to achieve this goal.
- Plant Science learning and teaching should be made more attractive through unified syllabi and curricula both at the Graduate and Post-Graduate levels.

98th Indian Science Congress

ISCA AWARDEES FOR 2010-2011

1. **ASUTOSH MOOKERJEE MEMORIAL AWARD**
   Prof. R. Ramamurthi, ISRO Scientist, Sri Venkateswara University; Tirupati

2. **C. V. RAMAN BIRTH CENTENARY AWARD**
   No Award

3. **SRINIVASA RAMANUJAN BIRTH CENTENARY AWARD**
   Prof. Allam Appa Rao, Vice-Chancellor, Jawaharlal Nehru Technological University, Kakinada

4. **S.N.BOSE BIRTH CENTENARY AWARD**
   Prof. Balram Bhargava, All India Institute of Medical Sciences, New Delhi

5. **S. K. MITRA BIRTH CENTENARY AWARD**
   Dr. T. Madhan Mohan, Ministry of Science and Technology, Govt. of India, New Delhi

6. **BIRBAL SAHNI BIRTH CENTENARY AWARD**
   Prof. B. Satyanarayana, President, Indian Akademy of Geo Science, Hyderabad

7. **S. S. BHATNAGAR MEMORIAL AWARD**
   Prof. D.Narayana Rao, Director (Research), S. R. M. University, Kattankulathur, T. N.

8. **VIKRAM SARABHAI MEMORIAL AWARD**
   Dr.V.K.Saraswat, Defence Research & Development Organisation, New Delhi

9. **D. S. KOTHARI MEMORIAL AWARD**
   Prof.T.K.Chandrashekar, Director, NISER, Bhubaneswar

10. **M.K.SINGAL MEMORIAL AWARD**
    Prof.Parameswaran Sankaran, Institute of Mathematical Sciences, Chennai

11. **PROF. R.C. MEHROTRA MEMORIAL LIFE TIME ACHIEVEMENT AWARD**
    Prof. Asutosh Sharma, IIT-Kanpur. Kanpur

12. **JAWAHARLAL NEHRU BIRTH CENTENARY AWARDS**
    1. Sri Ratan Tata, Sir Ratan Tata Trust, Bombay
    2. Dr.Naresh Trehan, Medanta-The Medicity, Gurgaon

13. **MILLENNIUM PLAQUES OF HONOUR**
    1. Prof. N. K. Gupta, Indian Institute of Technology, New Delhi
    2. Dr. J. S. Yadav, Indian Institute of Chemical Technology, Hyderabad

14. **G.P.CHATTERJEE MEMORIAL AWARD**
    Prof. Vinod Kumar Singh, Indian Institute of Science Education & Research, Bhopal

15. **B. C. GUHA MEMORIAL LECTURE**
    Prof. R. C. Mahajan, P. G. Institute of Med. Edu. and Research, Chandigarh

16. **PROF. SUSHIL KUMAR. MUKHERJEE COMMEMORATION LECTURE**
    Dr. Himangsu Pathak, Indian Council of Agricultural Research (ICAR) New Delhi

17. **PROF. S. S. KATIYAR ENDOWMENT LECTURE**
    Dr. Mitali Mukherji, Institute of Genomics & Integrated Biology, Delhi

18. **PROF. R.C. MEHROTRA COMMEMORATION LECTURE**
    Prof.V.Chandrasekhar, Indian Institute of Technology, Kanpur

19. PROF. G. K. MANNA MEMORIAL AWARD
Prof.Nirupama Agrawal, University of Lucknow, Lucknow

20. PROF. ARCHANA SHARMA MEMORIAL AWARD
Dr.Ananda Kumar Sarkar, JNU, New Delhi

21. JAWAHARLAL NEHRU PRIZE
Vigyan Parisad, Prayag Maharshi Dayanand Marg, Allahabad.

22. EXCELLENCE IN SCIENCE & TECHNOLOGY AWARD
Dr.V. M. Katoch, ICMR, New Delhi

23. PROF. HIRALAL CHAKRAVARTY AWARD
Dr. Manoj Prasad, National Institute of Plant Genome Research, New Delhi

24. PRAN VOHRA AWARD
Dr. Supradip Saha, Indian Agricultural Research Institute, New Delhi

25. DR. B. C. DEB MEMORIAL AWARD FOR SOIL/ PHYSICAL CHEMISTRY
Dr. B. Damodar Reddy, Central Tobacco Research Institute (ICAR), Rajahmundry

26. DR. B. C. DEB MEMORIAL AWARD FOR POPULARISATION OF SCIENCE
Mr. S. Senthilkumaran, M.S. Swaminathan Research Foundation (MSSRF), Chennai

27. PROF. UMAKANT SINHA MEMORIAL AWARD
No Award

28. PROF. R.C.SHAH MEMORIAL LECTURE
No Award

29. PROF. (Mrs.) ANIMA SEN MEMORIAL LECTURE
No Award

30. DR.(MRS.) GOURI GANGULY MEMORIAL AWARD FOR YOUNG SCIENTIST-ANIMAL, VETERINARY AND FISHERY SCIENCES
No Award

ISCA YOUNG SCIENTIST AWARDEES

1. AGRICULTURE AND FORESTRY SCIENCES
Sharmistha Pal, Indian Agricultural Research Instutute, New Delhi

2. ANIMAL, VETERINARY & FISHERY SCIENCES
Chinmoyee Maharana, National Brain Research Centre, Maneswar

3. ANTHROPOLOGICAL AND BEHAVIOURAL SCIENCES (INCLUDING ARCHAEOLOGY AND PSYCHOLOGY & EDUCATIONAL SCIENCES AND MILITARY SCIENCES)
Mithun Sikdar, Anthropological Survey of India, Udaipur

4. CHEMICAL SCIENCES
Moorthy Suresh, Central Salt and Marine Research Institute (CSIR), Bhavnagar

5. EARTH SYSTEM SCIENCES
Vikram Vishal, Indian Institute of Technology, Bombay, Mumbai

6. ENGINEERING SCIENCES
C. Prabhavathy, Indian Institute of Technology, Kharagpur

7. ENVIRONMENTAL SCIENCES
Linshy V. N., National Institute of Oceanography, Goa

8. INFORMATION AND COMMUNICATION SCIENCE & TECHNOLOGY (INCLUDING COMPUTER SCIENCES)
Prasun Ghosal, Bengal Engineering and Science University,W.B. Howrah

9. MATERIALS SCIENCE
Tirtha Som, Central Glass and Ceramic Research Institute, Kolkata

10. MATHEMATICAL SCIENCES (INCLUDING STATISTICS)

A.Sathya, Gandhigram Rural University, Dindigul, T.N.

11. MEDICAL SCIENCES (INCLUDING PHYSIOLOGY)

Smrati Bhadauria, Central Drug Research Institute,Lucknow

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

Bhalchandra K.Vaidya, National Chemical Laboratory, Pune

13. PHYSICAL SCIENCES

Thakur Prasad Yadav, Banaras Hindu University,Varanasi

14. PLANT SCIENCES

Hemant Sood, Jaypee University of Information Technology, Solan

ISCA BEST POSTER AWARDS

AGRICULTGURE AND FORESTRY SCIENCES

1. *A. Dutta, Radio and Atmospheric Sciences Division, National Physical Lab, New Delhi*
2. *Shantanu Kundu, Dept. of Biotechnology, Assam University Silchar.*

ANIMAL, VETERINARY & FISHERY SCIENCES

1. *A. Sharma, School of Studies in Neuroscience Jiwaji University, Gwalior.*
2. *Sippy Singh, Dept.of Zoology, University of Allahabad, Allahabad.*

ANTHROPOLOGICAL AND BEHAVIOURAL SCIENCES (INCLUDING ARCHAEOLOGY AND PSYCHOLOGY & EDUCATIONAL SCIENCE AND MILITARY SCIENCE)

1. *Meenal Dhall, Dept. of Anthropology University of Delhi, Delhi*
2. *Debanjana Sen, Dept. of Home Science, University of Calcutta, Kolkata.*

CHEMICAL SCIENCES

1. *Prabha Singh, Dept. of Chemistry, D.A.V.College, Muzaffarnagar.*
2. *S.Devikala, Dept. of Chemistry, S.R.M. University,Chennai.*

EARTH SYSTEM SCIENCES

1. *M. Loganathan, Directorate of Research and Virtual Education, SRM University, Chennai.*
2. *A. Shiroyleima, Dept. of Earth Sciences Manipur University, Canchipur, Manipur.*

ENGINEERING SCIENCES

1. *Saptarshi Basu, Technical Superintendent, General Secretary, MRDS, Kolkata.*
2. *Nikita Hari, Power Electronics and Drives, S.R.M. University, Chennai.*

ENVIRONMENTAL SCIENCES

1. *Sareen Sarah John, School of Environmental Studies, Cochin University of Science and Technology, Kalamassery, Kerala.*
2. *Sanjukta Dutta, Dept. of Chemical Technology, University of Calcutta, Kolkata.*

INFORMATION AND COMMUNICATION SCIENCE & TECHNOLOGY &(INCLUDING COMPUTER SCIENCES)

1. *Ajay Kumar Thakur, C.M.Science College, Dharbhanga, Bihar.*
2. *Ibrahim Hussain, S.R.M.University, Chennai.*

MATERIALS SCIENCES

1. *S. Das, Meghnad Saha Institute of Technology, Kolkata.*
2. *R.K.Singha, Dept. of Physics and Meteorology, IIT, Kharagpur.*

MATHEMATICAL SCIENCES

None

MEDICAL SCIENCES (INCLUDING PHYSIOLOGY)

1. *Neela De, Endocrinology &Reproductive Physiology Lab. University of Calcutta, Kolkata.*
2. *A. Sreedevi, Division of Pharmaceutical Chemistry, SPMVV, Tirupati.*

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

1. *Sarvanan Kumar, ICGEB, New Delhi*
2. *Puroshothaman Natarajan, S. R. M. University, Chennai*

PHYSICAL SCIENCES

1. *Mitali Konwar, Dept. of Physics, Moran College, Sibsagar.*
2. *V.Bena Jothy, Centre for Molecular & Biophysics Research, Thiruvananthapuram*

PLANT SCIENCES

1. *Mithilesh Kumar Jaiswal, Mycology Research Lab., R.D.University, Jabalpur*
2. *Bhoopinder Giri, Applied Mycology Lab., Dept.of Botany, Delhi University, Delhi.*

INFOSYS FOUNDATION–ISCA TRAVEL AWARD TO SCHOOL STUDENTS

1. *Harshita Damodaran,* Class-XII D.A.V. Matric Higher Secondary School, Chennai
2. *Karthik Kumaran R,* Class-XI, PSBB, Millennium School, Chennai
3. *Vijaylakshmi S.,* Class–XIIvs Sacred Heart Matri Higher Secondary School, Chennai
4. *Sherly Macbeth N,* Class–IX, Kendriya Vidyalaya, Chennai
5. *Sangavi M,* Class–XII, Sita Devi Garodia Matric Higher Secondary School, Chennai
6. *Namam Vashith,* Class–XI, Mukund Lal Public School, Haryana.
7. *Shreeja S,* Class–IX, Hindu Colony Chellammal Senior Secondary School, Chennai.
8. *Uma Pratheeba U.,* Class–XI, Sri Sankara Vidyalaya Matric Higher Secondary School, Chennai
9. *Vaibhav Gulati,* Class-XI, Mukunda Lal Public School, Haryana
10. *G. Natesh,* Glass–XI, DAV Matric Higher Secondary School, Chennai.

KNOW THY INSTITUTIONS

INDIAN INSTUTUTION OF INFORMATION TECHNOLOGY, ALLAHABAD

The Indian Institute of Information Technology ; Allahabad (IIT-A) was established in 1999, as a centre of excellence in Information Technology and allied areas. The institute was conferred the **"Deemed University"** status by Govt. of India in the year 2000. The Institute thus became empowered to have a perpetual seal and degrees subsequent to the conduct of its own examinations.

The Institute has been conceived with the ambitious objectives of developing professional expertise and skilled manpower in Information Technology (IT) and related areas. This will enable the country to exploit efficiently emerging opportunities, and meet economic challenges being thrown up by the rapid global IT revolution, which is influencing virtually every area of development and social activity. As an apex nucleating institute in the area of IT, the establishment of IIIT-A, is a major step of Govt. of India towards strengthening the indigenous capability necessary for exploting profifably and harnessing multidimensional facets of IT at all levels, and attaining expertise to enable the country to emerge as a leading player in the global arena.

The institute owes its existence to the vision and untiring efforts of Hon'ble Prof. Murli Manohar Joshi, Former Union Minister of Human Resource Development, Science and Technology and Ocean Development, GoI. Realizing the vital significance of IT in the years to come, Prof. Joshi, himself a reputed academician, has been instrumental to geeting this prestigious project conceived, initiated and executed in record time. The beautiful 100 acre campus, situated as Deoghat, Jhalwa, designed meticulously on the Penrose Geometry pattern, is being further topped by fine landscaping to give an

all round soothing effect to create a stimulating environment to indulge in the true pursuit of excellence in the field of Information Technology and Allied Sciences. The campus is envisaged to be a fully residential one, with all its faculty, staff and students housed in different pockets. All academic and residential areas are connected to the Institutes's network.

HISTORY

The Prime Minister of India constituted a National Task Force on IT and Software Development in 1998. The purpose of this committee was to make specific recommendations for the establishment of IT institutions that would produce a skilled IT workforce. The vision was to bring India to the frontier of the field of information technology.

The Ministry of Human Resources Development through its order of 1st July 1998 constituted the Rame Gowda Committee. This expert committee was to submit a project report regarding the feasibility and logistics of setting up a National Institute of Excellence in Information Technology with Allied Sciences. This Institute would carry out pioneering research and development with an emphasis on industry linkages and networking at national and international levels.

This Expert Committee met a number of times and discussed the vision and scope of the institute against the backdrop of technological innovations, particularly in the field of Information Technology, Accordingly, the decision was taken that it was an opportune moment for India to exploit and harness IT at all levels, from grass-root applications to top-notch software development.

The national task force on IT had suggesged a wide spectrum of recommendations spanning from wired-village concepts to $50-billion software development programs within 6-8 years. To achieve this target, there was an urgent need for massive manpower generation. Towards this end, the Task Force called for a number of front-ranking IT centers of excellence, of which the first was to be established in Allahabad.

The Expert Committee then proposed the profile of an institute with all the relevant details with regard to location, funding and governance. It also came up with a budget of Rs. 41.70 crores for the establishment of an institute at Allahabad. It was the hope of the members of the Committee that the setting up of this institute would usher in an era of establishment of such centers across the country. Furthermore, this institute was expected to emerge as a national centre of excellence in IT along with lime science and technologies.

For financial and administrative approval, these recommendations were placed before the Expenditure and Finance Committee at its meeting on the 30th of December, 1999.

IIITA MISSION

The mission of IIIT, Allahabad is to be a unique and world class nucleating "Apex Center of Excellence" in the area of Information Technology and Allied Sciences, so as to enhance India's Technology strength in IT and to become a pace-setting institution for other similar institutes to be establishment in the future. IIIT seeks to derive its strength from a linkage with sound Indian traditions of centuries past, and sets out to create knowledge-based resources in regional languages.

CHARTER

- To train and educate, at certificate, diploma, undergraduate and postgraduate level, engineers of outstanding ability, who may become leaders in the IT industry and profession.
- To carry out advanced research and development in leading edge technology areas in computer Hardware & Software, which can be useful on a comparatively long term basis.

- To develop and promote national and international linkages by way of adjunct faculty, partnership in research, student exchange, credit transfer and joint degrees.
- To work for the creation and development of resource database, associated software and courseware for all important applications, so as to ensure future availability of newer software technologies for English, Hindi and other Indian languages.

The syllabi and courseware are designed to be flexible and wide-ranging, incorporating the cutting edge as well as ensuring a firm grasp of core fundamentals. A modular course design, along with several opportunities for industry training, gives students the freedom to tailor their learning experience. The grading system is broadly based on the pattern of other IITs.

Education here is an enriching experience in more ways then one. With regular sporting, cultural and other extracurricular activities an IIITi has opportunities to develop multiple facets of his personality and achieve excellence in varied fields.

Collaborations with industry : An Indo-Russian Centre of Biotechnology specializing in bioinformatics is operational, and an Indo-US facility for a Universal Digital Library is being set up. A videoconferencing facility for networking with leading institutions in India as well as abroad is also in the works.

The campus-based Gyan Vani regularly broadcasts educational programme.

***Contact* :**

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Mebsite : http://www.iiita.ac.in

Conferences / Meetings / Symposia / Seminars

International Conference on Allied Health Science. Focal Theme : Trends & Impact of Health Professionals on Society 22-24th July 2011, Putra World Trade Centre (PWTC), Kuala Lampur, Malaysia.

Organised by : Lincoln College, Kuala Lampur.

Objective : Interchange of views and ideas and creating awareness among the nursing, pharmacy, physiotherapists, radiographers, medical assistants and other allied health to bring the eminent persons of international fame for sharing their ideas and views to improve their knowledge.

Abstract Submission : Deadline (to be published in the proceeding books in the month of August 2011) is 15th March 2011.

Contact : Dr. Sandeep Poddar, The Organizing Secretary, ICASH2011, Lincoln College, Mayang Plaza, Block A, No 1, Jalan SS 26/2 Taman Mayang Jaya, 47301 Petaling Jaya, Selangor Darul Ehsan, Kuala Lumpur, Malaysia, T: +603-7806 3479, F : +603-7806 3479, Email : info@icahs2011.com, Website : http://icahs2011.com

16TH World Congress on Clinical Nutrition, New Delhi, Sept 10-13, 2011, India Habitat Center, New Delhi, India.

Organised by : International College of Nutrition and Indian Society of hypertension.

Scientific Programme topics :

Biology and biochemistry of nutrients, health and disease.
Epidemiology of nutritional factors
Nutrition, risk factors and novel biomarkers
Nutritional modulation of genetic expressions and inheritance.
Prehypertension and premetabolic syndrome
Coronary artery disease and atherosclerosis
Nutrition, health and chronic diseases
Nutrition and the brain function
Foods and gut ; prebiotics and probiotics
Physical activity, nutrients and wellbeing
Nutraceuticals and functional foods
Complex and refined carbohydrates
Fats, oils and fatty acids
Macro and micronutrients
Food flavours
The Tsim Tsoum Concept of health and designer, foods
Agricultural Policy and designer cropses
New concepts in the prevention of undernutrition to prevent chronic diseases
Nutritional prevention of non-communicable diseases

Contact : Dr Amrat K Singh, Secretary General, 16th WCCN; 209, Competent House, F-14, Middle Circle,; Connaught Place, New Delhi-110 001; Fax 91 11 23323660, Tel 41523068, 46171020; Emails. icn2005@sancharnet.in,drkk@dataone.in, india@shikhar.com; website : http:/www.16thwccnindia.com/

S & T ACROSS THE WORLD

BIRD OF PARADISE PLANT

A breakthrough research by Florida University's biological scientists has identified bilirubin in the popular bird of paradise plant. The study expands the original research and reveals new insights into the presence of animal pigment in flowers. *Strelizia reginae Aiton*, the Bird of Paradise plant, is known for its vibrant orange and blue inflorescences.

Using high-performance liquid chromatography (HPLC) and Electorspray Ionization-tandem mass spectrometry, the research team discovered bilirubin to be the primary aril pigment of *Strelizia reginae* and found low concentrations of bilirubin in the plant's sepals. In mature aril tissue, bilirubin was present as granular bodies irregularly distributed throughout the cell. In mature sepal tissue, the researchers observed elongated structures that were previously identified as containing carotenoids. The findings will likely have broad appeal among flower lovers.

(*American Society for Horticulture Science, Sep 9, 2010*)

HUMAN BRAINS SHRINKING OVER LAST 20,000 YEARS'

Admit it or not, people may be becoming increasingly dumb, says a new study which has found that the human brain has been gradually shrinking over the last 20,000 years. According to the study, this decrease in size follows two million years during which the human cranium steadily grew in size and it has happened all over the world, to both sexes and every race.

"Over the past 20,000 years, the average volume of the human male brain has decreased from 1,500 cubic centimeters to 1,350/- cubic centimeters, losing a chunk the size of a tennis ball. The female brain has shrunk by the same proportion, "the Daily Mail" quoted as saying a report in 'Discover' magazine. In the magazine, author Kathleen McAuliffe reported on the comments made by Dr. John Hawks, an anthropologist from the University of Wisconsin, who argues that the fact the size of human brain is decreasing doesn't necessarily mean people's intelligence are in decline as well.

Some paleontologists agree with this diagnosis, that human brains may have become smaller in size, but increasingly efficient. But others believe man has indeed become steadily more stupid as he has evolved.

Several theories have been advanced to explain the mystery of the shrinking brain. One is that big heads were necessary to survive Upper Paleolithic life, which involved cold, outdoor activities. A second theory is that skull developed to cope with a chewy diet of rabbits, reindeer, foxes and horses. As our food has become easier to eat so human heads have stopped growing, according to supporters to this theory. Other experts say that with high infant mortality, only the toughest survived—and the toughest tended to have big heads. Therefore a gradually decreasing infant mortality rate led to proportionate decrease in the human brain size.

A recent study conducted by David Geary and Drew Bailey, congitive scientists at the University of Missouri, explored how cranial size changed as humans adapted to an increasingly complex social environment between 1.9 million and 10,000 years ago. They found that when population density was low, such as during the majority of human evolution, the cranium increased in size. But when a certain area's population changed from sparse to dense, human cranium size decreased. They concluded that increasingly complex societies emerged, the brain grew smaller because people didn't have to be as smart to stay alive.

SHANTI SWARUP BHATNAGAR PRIZES 2009 CITATIONS

BIOLOGICAL SCIENCES

Dr. Sanjeev Galande

Dr. Sanjeev Galande of the National Centre for Cell Science, Pune has made outstanding contribution to the understanding of how dynamic changes in higher—order chromatin architecture lead to spatiotemporal changes in gene expression. In particular his work has provided important insights into the role of the Wnt signaling pathway in T-cell development and differentiation.

Dr. Shubha Tole

Dr. Shubha Tole of the Tata Institute of Fundamental Research, Mumbai has made fundamental contributions to outstanding of brain development in identifying the mechanisms that control the formation of hippocamps, which controls learning and memory.

CHEMICAL SCIENCES

Dr. Sandeep Verma

Dr. Sandeep Verma of the Indian Institute of Technology, Kanpur has made significant contribution toward enzymes through metal mediated system and studied ordered peptide assemblies.

Dr. Swapan K Pati

Dr. Swapan K Pati of the Jawaharlal Nehru Centre for Advanced Scientific research, Bangalore has made significant contributions to understand novel electronic, optical and magnetic phenomena in molecular systems.

ENGINEERING SCIENCES

Dr. G. K. Anathasuresh

Dr. G. K. Anathasuresh of the Indian Institute of Science, Bangalore has made outstanding contributions in developing new theories and design techniques in emerging field of compliant micromechanisms, as well as made innovative inter-disciplinary contributions in bio-design.

Dr. Sanghamitra Bandyopadhyay

Dr. Sanghamitra Bandyopadhyay of the Indian Statistical Institute, Kolkata has made pioneering contributions to the theory and algorithms in evolutionary computation, pattern recognition and bioinformatics. Her computational studies on miRNAs and their involvement in cancer provide deeper insight into the functioning of these bio-mulecules, critical for developing new lines of therapy.

MEDICAL SCIENCES

Dr. Mitali Mukerji

Dr. Mitali Mukerji of the Institute of Geomics and Intergrative Biology (CSIR), Delhi has made outstanding contributions to genomics, particularly in deciphering the genomic underpinnings of some important neurological disorders. She has also provided leadership and important insights into the genomic diversity of the people of India, with profound implications on disease-association studies. She has pioneered integration of Ayurveda and Genomics.

PHYSICAL SCIENCES

Dr. Kalobaran Maiti

Dr. Kalobaran Maiti of the Tata Institute of Fundamental Research, Mumbai has made outstanding contributions in the field of very high resolution photoelectron spectroscopy in understanding the physics of metal-insulator transition, charge density wave and Kondo system.

Dr. Umesh Vasudeo Waghmare

Dr. Umesh Vasudeo Waghmare of the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore has made outstanding contributions in developing abinitio methods and using microscopic models that capture the spirit of soft modes, magnetism, defects & chemical disorder in materials in understanding key properties of bulk and nano scale materials.

EARTH, ANTHOSPHERE, OCEAN & PLANETARY SCIENCES

No Award

MATHEMATICAL SCIENCES

No Award

Cth;eg ÂJÒttl fÙtdm mô:t

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THE INDIAN SCIENCE CONGRESS ASSOCIATION

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JcmtRx/Website : http://sciencecongress.nic.in
iscacal_2004@yahoo.com

m=ôg;t fle N;ì yth m=ôgt fle ÂJNMtÂ"fÙth/Terms of Membership and Privileges of Members :

mô:t fle m=ôg;t Wl mCe jtdt fÙ ÂjY Fj n st ôlt;fÙ gt Wmf mbtl ô;h vh NGÂKfÙ gtÉg;t ysl fÙh af n yth Âsàn Cth; Âf ÂJÒttl fÙ ;h¢fle b ÁÂa n›

Membership of the Association is open to person with *Graduate or equivalent academic qualification* and interested in the advancement of science in India.

1. **JtÂMfÙ m=ôg** & st ôgÂÿ lg Áv m JtÂMfÙ m=ôg;t dnK fÙhlt atn;t n Wm JtÂMfÙ m=ôg;t NÖf Á 200/- fÙ mt: C;e NÖf Á 50/-* (ÂJ=ÂNgt fÙ ÂjY** U.S.$ 70) btºt =l vzd› JtÂMfÙ m=ôg;t NÖf ŒÀgfÙ JM fÙ 01 yŒj fÙt =g nt stYdt› st Ce 15 sjtR fÙ Ce;h yvle m=ôg;t NÖf lne y=t fÙh vtYdt Jn Wm mtj fÙ ÂjY yvle Jtx =l fle Gb;t m JÂa; nt stYdt yth/gt Jn Wm JM fÙ ÂjY mô:t fÙ fÙtgtjg fÙt Ce ÂlgºtK lné fÙh vtYdt› YfÙ m=ôg st JtÂMfÙ m=ôg NÖf ydj mtj fÙ bta fÙ y; ;fÙ lné = vtYdt Wmfle m=ôg;t mbtË; nt stYde›

   m=ôgdK yvlt vvh fÙtdm mºt fÙ mbg vN fÙh mfÙ; n› Wàn JtÂMfÙ ÂJÒttl fÙtdm mºt fle fÙtgÂJJhK fle YfÙ ŒÂ; Âcltbög b ŒtË; nt mfÙ;e n› RmfÙ mt: J mô:t fÙ htsltbat llYJhebl m mtRm00 Ce Âcltbög Wvjç" fÙh mfÙ; n›

1. **Annual Member :** A person willing to be enrolled as new Annual Member has to pay an annual subscription of Rs. 200/- along with an admission fee of Rs. 50/-* (for foreign** U.S.$ 70) only. The annual subscription of a Member shall become due on the 1st April of each year. Anyone who fails to pay the subcription on or before the *15th July* in any year shall lose the right of voting and/ or holding any office of the Association for that year. A member failing to pay the annual subscription by the end of March of the following year shall cease to be a Member.

   Members may contribute papers for presentation at the Science Congress. They will receive, free of cost, reprints of the Proceedings of the Session of any one section of their interest and also the bi-monthly journal of the Association "Everyman's Science".

2. **mºt m=ôg** & gÂ= f‖A f‖thKt m JtÂMf‖ m=ôg yvle m=ôg;t Wm JM f‖ 15 sjtR f‖ y=h =tnhtlt Cj stY ;t Wlf‖e m=ôg;t mºt m=ôg;t f‖ Áv b Âclt Jtx ztjl f‖e Gb;t b meÂb; f‖h Â=gt stYdt› JtÂMf‖ m=ôg yvle m=ôg;t =tctht ydj mtj Âclt C;e NÖf Â=Y yvle m=ôg;t NÖf f‖t Xef‖ mbg vh =f‖ vl& ŒtË; f‖h mf‖;t n›

2. **Sessional Member :** If for some reasons, Annual Members fail to renew their Membership by remitting subscription prior to 15th July each year, their Membership for the year would be restricted to Sessional Membership without voting right. Annual members can renew their Membership without paying the admission fee in the next year by remitting subscriptions in time.

3. **Atºt m=ôg** & st ôgÂÿ‖ ôlt;f‖ ô;h f‖ lea vZtR f‖h hnt n Jn JtÂMf‖ m=ôg;t NÖf Á 100/- btºt =l vzd› yvlt ltb Atºt m=ôg f‖ Áv b ÂjFJt mf‖;t n cN; Wmf‖ ytJ=l vºt vh Wmf‖ Œtatg/ ÂJCtdtÉgG/mô:tl f‖ Œ"tl f‖ nô;tGh nt› Yf‖ Atºt m=ôg f‖t gn yÂ"f‖th Â=gt stYdt Âf‖ Jn yvlt vvh f‖tdm mºt f‖ mbg vN f‖h mf‖ cN; Jn vvh Jn Âf‖me JtÂMf‖ m=ôg gt mô:t f‖ f‖tR yJ;Âlf‖ m=ôg f‖ mt: vN f‖h› Wm Jtx f‖hl f‖t gt f‖tgtjg f‖t ÂlgºtK f‖hl f‖t yÂ"f‖th ŒtË; lné ntdt› Atºt m=ôg f‖t ÂJCtdt f‖ ôgJmtg cXf‖t yth mt"thK cXf‖t b Ctd jl f‖e gtÉg;t ŒtË; lné n›

3. **Student Member :** A person studying at the under-graduate level may be enrolled as a Student Member by paying an annual subscription of Rs. 100/- only provided his/her application duly certified by the Principal/Head of the Institution/Department. A student member shall have the right to submit papers for presentation at the Session of the Congress of which he/she is a member, provided such papers be communicated through a Member, or an Honorary Member of the Association. He/she shall not have the right to vote or to hold any office. A student member shall not be eligible to participate in the Business meetings of the Sections and the General Body.

4. **ytseJl m=ôg** & Yf‖ m=ôg yvl CÂJíg f‖e mthe ctÂMf‖ m=ôg;t NÖf Yf‖ cth b Áv 2000/- (ÂJ=ÂNgt f‖ ÂjY U.S.$ 500) btºt y=t f‖hf‖ vt mf‖;t n› Yf‖ ôgÂÿ‖ st 10 mtj gt Wmm yÂ"f‖ ÂlgÂb; Áv m m=ôg;t ŒtË; f‖h af‖t n, Wm Wmf‖e mgÿ‖ m=ôg;t NÖf f‖ Wvh ŒÂ;JM Á 50/- f‖e Ax =e stYde, cN; Âf‖ Wmf‖e mgÿ‖ NÖf Á 1,200/- m lea l nt (ÂJ=ÂNgt f‖ ÂjY U.S.$ 12.50 yth U.S.$ 300 f‖bN&)› Yf‖ ytseJl m=ôg f‖t Wmf‖ vh seJl f‖tj b m=ôg;t f‖e mthe ÂJNMtÂ"f‖th ŒtË; ntd›

4. **Life Member :** A Member may compound all future annual subscriptions by paying a single sum of Rs. 2000/- (for foreign** U.S.$ 500) only. Any person who has been continuously a member for 10 years or more, shall be allowed a reduction in the compounding fee of Rs. 50/- for every year of such membership, provided that the compounding fee shall not be less than Rs. 1,200/- (for foreign** U.S.$ 12.50 and U.S.$. 300 respectively). A life Member shall have all the privileges of a member during his/her lifetime.

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* C;e NÖf Á 50/- ÂmV‖ Yf‖ lg JtÂMf‖ m=ôg f‖ ÂjY sÁhe n› gn mºt m=ôg/ytseJl m=ôg/ mô:tl m=ôg/Atºt m=ôg/=t;t f‖ ÂjY sÁhe lné n›

* Admission fee of Rs. 50/- is needed only for becoming a new Annual Member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.

** (Yf\ ÂJ=Ne m=ôg f\t y: n st Cth;JM f\ ctnh f\t ltdÂhf\ nt)›

** (A Foreign Member means one who is normally resident outside India).

5. **mô:tl m=ôg** & Yf mô:tl st Á 5,000/- m=ôg;t NÖf f\ Áv b = Jne mô:t f\ mô:tl m=ôg cl mf\;t n (ÂJ=ÂNgt f\ Âj Y U.S.$ 2,500)› Rmb Jn Âcòttl f\tdm f\ JtÂMf\ mºt b yvl Yf\ ôgÂÿ\ f\t ltb ltbtÂf\; f\h mf\;t n st Wlf\t ŒÂ;ÂlÂ" nt› Yf\ mô:tl m=ôg f\t JtÂMf\ ÂJòttl f\tdm mºt f\e f\tgÂJJhK f\e Yf\ vK ŒÂ; Âcltbög b ŒtË; nt mf\;e n› Rmf\ mt: J mô:t f\ htsltbat llYJhebl m mtRm00 Ce Âcltbög Wvjç" f\h mf\; n›

5. **Institutional Member :** An Institution paying a subscription of Rs. 5,000/- (for foreign** U.S.$2,500) only, can become an Institutional Member of the Association. It shall be eligible to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional Member shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also a copy each of the Association's journal "Everyman's Science".

6. **=t;t** & f\tR Ce ôgÂÿ\ st Yf\mt: Á 10,000/- (ÂJ=ÂNgt f\ Âj Y U.S.$ 5000) btºt = Jn mô:t f\ =t;t cl mf\; n› Yf\ ôgÂÿ\d; =t;t f\t Jn mthe yÂ"f\th yth ÂJNMtÂ"f\th Âbjd st Yf\ m=ôg f\t Wmf\ vK seJl f\tj b ŒtË; nt; n› Yf\ mô:tl st Yf\mt: Á 50,000/- (ÂJ=ÂNgt f\ Âj Y U.S.$ 25,000) btºt = Jn mô:t f\ mô:tl =t;t cl mf\;t n, Âsm Yf\ ôgÂÿ\ f\t ltbtÂf\; f\hf\ Wm yvl mô:tl f\ ŒÂ;ÂlÂ" f\ Áv b ÂJòttl f\tdm f\ JtÂMf\ mºt b Cs mf\; n› Yf\ mô:tl/ôgÂÿ\d; =t;t JtÂMf\ ÂJòttl f\tdm f\ f\tgÂJJhK yth mô:t f\ htsltbat llYJhebl m mtRm00 Ce Âcltbög Wvjç" f\h mf\; n›

6. **Donor :** Any person paying a lump sum of Rs. 10,000/- (for foreign **U.S. $5000) only, can become a Donor of the Association. An ***INDIVIDUAL DONOR*** shall have all the rights and privileges of a member during his/her lifetime. An Institution paying a lump of Rs. 50,000/- (for foreign U.S. $25,000) only, can become an ***INSTITUTIONAL DONOR*** of the Association, which shall have the right to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional/Individual Donor shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also the Association's journal "Everyman's Science".

(y) **vvh vN f\hlt** & Yf\ vK vvh f\e ŒÂ; Wmf\ mt: ;el mthtN f\e ŒÂ; st 100 Nç=t m ßgt=t l nt yth Âsmb f\tR ythF gt V\bjt l nt, Jn ŒÀgf\ JM 15 Âm;öch f\ y=h bntmÂaJ (bÏgtjg) ;f\ vna stlt atÂnY›

(A) **Presentation of Papers :** A copy of complete paper accompanied by an abstract in triplicate not exceeding one hundred words and not containing any diagram or formula, must reach the General Secretary (Hqrs) latest by September 15, each year.

(c) mCe Jdt f\ m=ôg st ÂJÒttl f\tdm mºt b Ctd j l f\ vëat; jtx; mbg f\ Âxf\x b Âhgty; ŒtË; f\h mf\;t n cN; Âf\ Wlfle gtºtt f\ Fa f\t :tzt Ce Ctd mhf\th (f\Šeg gt htßg), f\tR f\tl\le mútt gt f\tR ÂJëJÂJ'tjg gt f\tR ldhvtÂjf\t l WXtY›

(B) Members of all categories are entitled to railway Concession of return ticket by the same route with such conditions as may be laid down by the Railway Board for travel to attend the Science Congress Session provided that their travelling expenses are not borne, even partly, by the Government (Central or State), Statutory Authority or an University or a City Corporation.

(m) mô:t f\ vô;f\tjg b mCe Jdt f\ m=ôg f\t vZl f\e mÂJ"t mcn 10,00 cs m Ntb f\t 5.30 cs ;f\ mCe f\tb f\ Â=lt b (NÂlJth yth hÂJJth) f\t Atzf\h ŒtË; ntde›

(C) Members of all categories are entitled to reading facilities between 10.00 a.m. to 5.30 p.m. on all weekdays (except Saturdays & Sundays) in the library of the Association.

(z) mbg mbg vh mô:t Ãtht ;g f\e dR bÖg vh ÂJ¶tbdn, mCtdth ytÂ= mÂJ"tyt f\e ŒtÂË; Ce mCe Jdt f\ m=ôg vt mf\; n ›

(D) Members of all categories may use Guest House facilities, Lecture Hall hiring at the rates fixed by the Association from time to time.

(R) CÂJíg b Cth;eg ÂJÒttl f\tdm mô:t Ãtht ytgtÂs; vÂhmJt=, möbj l yth JtÂMf\ f\tdm b mCe Jdt f\ m=ôgt Ãtht Ctd j l f\ ÂjY yvle-yvle m=ôg;t vºt f\t jtlt sÁhe n›

(E) Members of all categories should bring the Membership Card always for attending any Seminar, Conference and Annual Congress organized by ISCA in future.

Agtl = & mCe cf\ ztÜx "Treasurer, The Indian Science Congress Association" f\ ltb m ne ÂjFt stY yth f\tjf\t;t f\ Âf\me Ce NtFt b =g nt› m=ôgt m gn ÂlJ=l Âf\gt st hnt n Âf\ J yvle m=ôg;t mÏgt f\t W¨F Cth;eg ÂJÒttl f\tdm mô:t f\ f\tgtjg f\ mt: vºttath f\ ôgÿ\ yJëg f\h›

Note : All Bank Drafts should be drawn in favour of "Treasurer, The Indian Science Congress Association" Payable at any branch in Kolkata. Members are requested to mention their Membership No. while making any correspondence to ISCA office.

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JcmtRx/Website : http://sciencecongress.nic.in
iscacal_2004@yahoo.com

m=ôg;t fl Âjy ytJ=l - vºt/ Application Form For Membership :

mJt b/To
bntmÂaJ (bÏgtjg)/ The General Secretary
Cth;eg ÂJÒttl fltdm mô:t/The Indian Science Congress Association
14, ztO ÂchN dnt ôxex/14, Dr. Biresh Guha Street,
fltjflt;t - 700 017/Kolkata - 700 017

bnt=g/Dear Sir,

b Cth;eg ÂJÒttl fltdm mô:t flt ytseJl m=ôg/JtÂMfl m=ôg/mºt m=ôg/Atºt m=ôg/mô:tl m=ôg/ =t;t/ yvlt ltb ÂjFJtlt atn;t / atn;t n›

I like to be enrolled as a Life Member/Annual Member/Sessional Member/Student Member/Institutional Member/Donor/of The Indian Science Congress Association.

b Rmfl mt: Á _____ m=ôg;t NÖf fl Áv b lfl=/cfl ztÜx mÏgt _____ Â=ltÂfl; _____ Œatjfl cfl _____ 01 yŒj —— m 31 bta —— ;fl Cs hnt/hne n›

I am sending herewith an amount of Rs. ———— in payment of my subscription by Cash/Bank Draft No. ———— dated ———— issuing bank from the year 1st April —— to 31st March ——.

b ÂlölÂjÂF; ÂJCtd b ÁÂa hF;t/hF;e n (Âflme Yfl b flvgt ÂlNtl jdtY)/ I am interested in the following section (Please tick any one).

ÂJCtd/Section

1. flÂM yth JlÂJ't ÂJÒttl/Agriculture and Forestry Sciences
2. vN, vNÂaÂflÀmt yth bÀôg ÂJÒttl/Animal, Veterinary and Fishery Sciences
3. btlJNtôºteg yth ytahK ÂJÒttl (Âsmb mÂöbÂj; n vht;ÀJ-ÂJÒttl yth bltÂJÒttl yth NÂGfl ÂJÒttl yth mlt ÂJÒttl/Anthropological and Behavioural Sciences (including Archaeology and Psychology & Educational Sciences & Military Science)
4. hmtgl ÂJÒttl/Chemical Sciences

5. C-võÂ; ÂJÒttl/Earth System Sciences
6. yÂCgà;t ÂJÒttl/Engineering Sciences
7. Jt;tJhK ÂJÒttl/Environmental Sciences
8. malt yth mathK ÂJÒttl yth Œt'tÂdfle (flövxh ÂJÒttl mÂöbÂj;)/Information and Communication Science & Technology (including Computer Sciences)
9. CtÂ;fl ÂJÒttl/Materials Science
10. dÂK; ÂJÒttl (mtÂÏgfleg mÂöbÂj;)/Mathematical Science (including Statistics)
11. ÂaÂflÀmt Ntô°t (Nheh ÂJÒttl mÂöbÂj;)/Medical Sciences (including Physiology)
12. lgt seJÂJÒttl (seJ hmtgl, seJ CtÂ;fle yth ytKÂJfl seJÂJÒttl yth seJ-Œt'tÂdfle mÂöbÂj;)/ New Biology (including Bio-Chemistry, Biophysics & Molecular Biology and Biotechnology)
13. CtÂ;fleg ÂJÒttl/Physical Sciences
14. JlôvÂ; ÂJÒttl/Plant Sciences

(flvgt xÂfl; flh gt çjtfl yGht b Ch/Please type or fill up in Block Letters)

ltb/Name (çjtfl yGht b/in block letters) : _____ _____

flj ltb/Surname Œ:b ltb/First Name

_____

bÆg ltb/Middle Name

NtGÂKfl gtÉg;t/Academic Qualifications :
(ŒbtK sbt flhlt n/Evidence to be submitted)

v=ltb/Designation :

mövfl flt v;t/Address of communication :
(htßg, Nnh/ldh yth Âvl fltz mÂn;/including state, city/town and pin code)

=hCtM mÏgt yth R-bj/Phone No. & E-mail :
(ydh fltR/if any)

ô:tge v;t/Permanent Address :

ÂxËvKe (ydh fltR)/Comments (if any)

CJ=eg/Yours Faithfully

Â=ltfl/Date : nô;tGh/Signature

Agtl =& (i) mCe cf\ ztÜx "Treasurer, The Indian Science Congress Association" f\ ltb m ne Âj Ft stY yth f\tj f\t;t f\ Âf\me Ce NtFt b =g nt›

Note : (i) All Bank Drafts should be drawn in favour of "Treasurer, The Indian Science Congress Association" Payable at any branch in Kolkata.

(ii) *10 yÿ\ch, 2004 f\ f\tgtÂhKe mÂbÂ; f\ Œô;tJ f\ ylmth Cth;eg ÂJÒttl f\tdm mô:t f\e m=ôg;t f\ Âj Y ytJ=l b Âf\me yàg ôgÂÿ\ f\ lbtV\;0 f\t mtbtàg;& n;tÀmtÂn; Âf\gt dgt n› vh; ÂV\h Ce gÂ= ytJ=lvºt b lbtV\;0 f\t v;t Â=gt hndt ;t Wmb Âsm ôgÂÿ\ f\t ltb Â=gt hndt Wmf\ nô;tGh Ce sÁhe n›

(ii) *As per resolution of Executive Committee in its meeting held on October 10, 2004 application for membership of ISCA in 'Care of' of some other person is generally discouraged. However, if in the application from "care of" address is given then there should be also signature of the person in whose name "care of" is given.

(iii) *C;e NÖf Á 50/- ÂmV\ Yf\ lg JtÂMf\ m=ôg f\ Âj Y sÁhe n› gn mºt m=ôg/ytseJl m=ôg/mô:tl m=ôg/Atºt m=ôg/=t;t f\ Âj Y sh¥he lné n›

(iii) *Admission fee of Rs. 50/- is needed only for becoming a new annual member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.

(iv) m=ôgt m gn Âlj=l Âf\gt st hnt n Âf\ J yvle m=ôg;t mÏgt f\t W¨F Cth;eg ÂJÒttl f\tdm mô:t f\ f\tgtjg f\ mt: vºttath f\ ôgÿ\ yJëg f\h›

(iv) Members are requested to mention their Membership No. while making any correspondence to ISCA office.