EVERYMAN'S SCIENCE

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COVER PHOTOGRAPHS *(Left to Right)*

Past General Presidents of ISCA

1. Dr. D. N. Wadia (1942, 1943)

2. Prof. S. N. Bose (1944)

3. Sir S. S. Bhatnagar (1945)

4. Prof. M. Afzal Husain (1946)

5. Pandit Jawaharlal Nehru (1947)

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CONTENTS

EDITORIAL

WHERE IS "HE, WHO CAN" TEACH ?

An adage often attributed to George Bernard Shaw goes as—"He, who can, does ; he, who cannot, teaches." The history of education of the world, however, shows that such an aphorism does not have universal credence among the intellectuals and the educationists. The international community of teaching profession can boast of excellence in teaching at all levels and there were teachers who volunteered for this profession and were not forced by compulsion. Nevertheless, teachers have been accused of mediocrity and non-creativity despite their conscientious effort.

The great educator J P Monroe, in his book "Profession of Teaching" questioned whether a professor should be professional in his profession. He prescribed that a teacher should have wide education, a slow and laborious preparation, a careful and humble apprenticeship and the poise of mind that follows it. The teachers have, often rightfully, complained of the grievous condition of things that they had to face and the contemptuous toleration on the part of the guardians and the public, in general. Monroe suggests that teachers have to render work of such quality that forbids this indifference.

In India, during the last sixty years the government has formulated and reformulated policies to attract good quality teachers in schools and colleges. A number of committees and commissions came out with their prudent reports. In some cases the government has given due consideration to these reports.

In the decades of fifties and sixties many colleges and universities were fortunate to have excellent and dedicated teachers. Afterwards the working conditions of teachers improved and attempts were made so that they were treated at par with other learned professionals in the public sector. But the teaching personnel have to be drawn from the same pool of human resources that were available to the other public services as well as the private sectors. So the authorities of the teaching institutions have to face an uphill task of competing with other sectors while recruiting professors. The ultimate fallout, as it happens in many cases (not all), is that the teaching institutions are obliged to be content with those, "who cannot "(G B Shaw). So the profession gets filled with such unwilling persons, who are industrious but lack urgent instinctual needs.

No one can be blamed right away for this state of affairs. The government has done what it could do to improve the emoluments and the appointment authorities have made best effort to girt the best people. (They indeed did it in many cases). But the society has now opened up and the world is too competitive and the younger generation has always the freedom to choose the profession considering all the advantages.

A point of serious concern is the case of colleges and universities in smaller towns in places far away from the big or metro cities. The teaching positions are announced in the usual way. But the selection committees have the distressing experience that in many cases there are two or three candidates for one or two positions at the level of lecturers and readers. With this limited choice quite often no one can be selected. Nevertheless, the authorities have to fill in the positions as they need persons to conduct the regular sessions. Surprisingly, the situation was far from this a few decades ago when the same universities could find highly qualified and capable teachers. It cannot be true that the quality of the students coming out of the universities has suddenly fallen. Now the brightest students

after completion of their doctoral work have many other opportunities that are more attractive than the same in the teaching institutions.

In spite of the state efforts there is a governmental and social perception that educational institutions are non-productive in the sense that they do not produce commodities of immediate market value. However, all the public and private sectors are consumers of the products of the universities. It should be noted that the industry and public enterprises need not only the best quality students but they also have to depend on people of different qualities for running the entire system. The government initiative to set up institutions of excellence for producing bright students is brave. But the general level students, who are much larger in number, need also to be nurtured. The industry, being the biggest consumer of the university products at all levels, should have a positive role in higher education in their own interest. Depending on their capabilities they may come forward to sponsor some of the colleges and/or universities so as to upgrade their infrastructure and improve the quality of the students, who directly or indirectly would benefit the industries. They occasionally sponsor some of the institutions of excellence, but the other institutions, in general, remain neglected. This cannot lead to inclusive growth.

After sixty years of effort for improvement of science and technology in the country, statistics show that we could have done much better in this field than what we have achieved in this period. Statistics always tell the truth. It is time that the policy makers should deftly attempt improvement of teaching standard in general so as to attract teachers, who have zeal and dexterity. All the students in the country need elementary knowledge of the basics of science. This can be done only by good quality enthusiastic teachers. Now the big question is—How to find out teachers of science ?

Prof. P. N. Ghosh

'Faith is to believe what we do not see. The reward of faith is to see what we believe'

—St. Augustine

PRESIDENTIAL ADDRESS

GIVE SCIENCE A CHANCE

SIR SHANTI S. BHATNAGAR*, KT., O. B. E., D. SC., F. R. S.

INTRODUCTION

I am deeply grateful to the Indian Science Congress Association for the great honour they have conferred upon me by electing me as their President for this year. I had considerable diffidence in accepting this high distinction, particularly as after my election I received an invitation from His Majesty's Government to visit Great Britain, and I was not certain whether I could return from this trip and a subsequent visit to the U. S. A. in time to be able to preside over the annual general meeting in Nagpur in January 1945. I was, however, assured by the Government of India in April last that I would be able to return in good time to preside over the session of the Indian Science Congress, and that I should not refuse an honour which is offered only once in one's lifetime. My colleagues who have been visiting England and the U. S. A. with me advised me to send the Presidential address in good time, so that it could be read on my behalf by some one else in case I was unable to reach India in time to preside over the meeting on the 2nd January 1945, and they strongly dissuaded me from resigning the Presidentship. Several happenings, however, particularly the events connected with D-day and the advent of flying bombs and rockets, unfortunately so much delayed our visit to England that it now seems almost certain that I shall not be able to be present with you in body at the time of the general meeting. I shall, however, be present in spirit and I hope under the able management of the local secretaries at Nagpur and the secretaries of the Indian Science Congress Association the session will be celebrated with the usual dignity and keen interest. I am fully aware of the deep interest which His excellency the Governor of your province has taken in making this session a great success. It is a great disappointment to me that I am unable to take advantage of His Excellency's gracious offer to hospitality during the session.

Before I begin my address I must refer to the sad loss which our country and the world of Science has suffered by the passing away of our great Acharya Sir Prafulla Chandra Ray. He was President of the session when the Indian Science Congress first met at Nagpur in 1918. Men of his type are not born everyday, and our motherland will not easily recover from the shock caused by the death of a son so highly distinguished for his scientific achievements and patriotic services in many fields.

VISIT OF PROFESSOR A. V. HILL

Perhaps the most outstanding event in the scientific life of India during the past year was the visit which Professor A. V. Hill, Nobel Laureate and Secretary of the Royal Society of London, paid to us at the request of the Government of India. The invitation to Professor Hill has been generally taken as an indication of the interest the government of India is taking in securing the aid of

* General President, Thirty Second Indian Science Congress held in January, 1945 at Nagpur.

Science in problems of national development to which they are committed during the post-war period. It was largely owing to the insistence of the Council of Scientific and Industrial Research that more financial aid should be given to Science, that such an invitation could be conceived even during the war. One must not forget, however, the part played by *Science and Culture* which under the able editorship of our distinguished physicist, Professor M. N. Saha, always criticised the Government for lack of interest in matters scientific and for scanty provision of funds.

Several officials in the Government and the public outside thought they detected in this criticism motives of jealousy, as there is no doubt that the Council of Scientific and Industrial Research had achieved important results in spite of inadequate financial assistance from the Government and industries, and deserved the fullest support from all friends of Science and industry. Nothing could be further from the truth than this suspicion. No more ardent supporter of Science, and of national development through it, exists in India than Professor Saha and I take this opportunity of acknowledging the help I have always received from him in my lonely fights for better recognition of Science in my country. Every form of unofficial support, on which alone one can finally depend for a democratic realisation of the role of Science in nation building, always came unhesitatingly from him and his colleagues.

It is a happy augury that the report made by Professor A. V. Hill had an unusually short incubation period. Following his recommendations the Government of India have already created a Department of Planning and Development and the Council of Scientific and Industrial Research has been transferred to this portfolio. Other research activities under the Government are likely to follow suit. I am sure the scientists assembled here have special reason to be happy in the fact that the choice of the Viceroy for the care of this new portfolio has fallen upon Sir Ardeshir Dalal who has been a past-president of the Indian Science Congress and who commands the confidence and respect of the scientists as well as of the business community of India. It is hoped that other far-reaching recommendations of Professor A. V. Hill will also be accepted by the Government of India. There is no better method of raising the standard of Science and scientists in this country than that so ably developed and skilfully described in his address before the last session of the Indian Science Congress.

INDIAN SCIENTIFIC MISSION TO U. K., U. S. A. AND CANADA

Another direct outcome of Professor A. V. Hill's visit to India has been that a mission of scientific workers from our country has been touring the U. K. and has arranged to go over to the U. S. A. and Canada, to observe the scientific, industrial and agricultural developments which have come about in these countries during the war and then to make recommendations and suggest plans for a further interchange of information and knowledge for mutual help and cooperation. India has been cut off intellectually for more than five years from the rest of the world and that in itself is a disaster the magnitude of which is directly proportional to the vast strides Science and research have made in the U. K.

My present visit to England has been the greatest eye-opener to me and I have now seen with my own eyes the high levels to which scientific invention and ingenuity have risen during the war. Not only has Science helped in developing weapons and instruments which are essential for success in a mechanical warfare, but it has aided industry and agriculture in supplying the basic needs of humanity during a period of great difficulty. The results both in military and human terms have been most encouraging. The large-scale application of radio-location, the jet propelled planes, the numerous

types of jettison tanks and unbreakable containers, the automatic weapons of offence and defence and scores of new alloys and novel metallurgical processes have had far-reaching consequences on the course of the war. The technique of operational research, the use of scientific methods of determining tactics of developing a national food policy, the discovery of penicillin and D. D. T. all these have contributed much to the realisation by the common man and the Government that organised Science is one of the most important factors in national development. It is a tragedy that a ruthless war and almost universal bloodshed should be necessary for this new awakening, for it should have been obvious without it that Science can play and must play an essential part for human advancement. In fact, unless opportunities are provided for Science to explore these possibilities for human betterment, a better world cannot be created.

There is no doubt that England is sparing no effort to approach the Peace much better informed and equipped than after the last war and the signs of this new awakening are visible in the universities, the Government departments, in industry, the agricultural and medical institutions and in every other walk of life.

As representatives of Indian Science, we have been welcome everywhere. The Government, The Royal Society and other learned societies, the universities, the Department of Scientific and Industrial Research and the Research Associations and the National Institutions associated with it, the agricultural and medical institutions, the clubs, the British Council and the industries and trades, the social and political organisations, the public schools and important private individuals have vied with one another to have us for teas, for luncheons and dinners and for speeches for which we have become notorious all over the country ! Everyone seems to regard our visit as a prelude to better understanding and trade relationships between our respective countries and as a gesture of friendship from the British Government, British Science and British industry to India. Even Ireland has not insisted upon isolation and strict neutrality and I had a most pressing invitation to address the University was extended to my opposite number in the U. K., Sir Edward Appleton, as I pleaded that I was tied up with engagements with him and could not visit Ireland unless he also came with me. An important member of His Majesty's Government's Hospitality department told the Assistant Secretary of the Royal Society that even Kings visiting England did not receive such a warm welcome as the Indian scientists have received ! All this is an indication of the keen interest people in England are taking in Science and research.

SCIENCE IN THE BRITISH UNIVERSITIES

We found most Universities denuded of their ablest workers. They were nearly all engaged in important war work and visited their departments only occasionally. They were busy with meetings and committees and in special scientific work related to the war-effort : but all the same they are all devoting their attention to the future of Science in British universities. The Association of Scientific Workers has submitted a memorandum to the University Grant Committee of the Treasury suggesting what reforms in teaching and research should be taken in hand immediately after the war and better provision for Science should be made in the universities. Their report ends with the following strong plea.

> "We reiterate, then, our plea for the utmost vision and flexibility in budgeting for the development of Science in the universities. Where the flowering of intellect is concerned, any accurate prediction is impossible. We are convinced, however, that peace can see at least as rapid a growth in all fields of Science as war has brought about in some special applications. The only proper attitude for an enlightened

community is to make available the financial and material resources appropriate to each stage of development. We are far from being in sight of either the limits of Science or the end of our reserves of intelligence. Bold and flexible thinking is therefore the prime necessity in framing post-war policy for the universities."

Out of the many important recommendations made by the Association of Scientific Workers for the expansion of scientific activities in the universities, the following are quoted so that the Indian universities may take a lesson from what is now the train of thought in Great Britain :

1. Schools of fundamental research must be fostered in the universities, expansion proceeding as fast as talent appears.
2. All graduates with an aptitude for research should be offered full maintenance while working for a higher degree.
3. Research fellowships should be provided for those who have taken doctorate degree.
4. When men are appointed mainly to do research they should have to have the same status and salary as those appointed mainly for teaching.
5. Research committees should be set up in every university to watch over the development of research, especially in borderline subjects, and prepare an annual research budget.
6. The education and training of laboratory technicians should be given immediate attention. Courses should be planned for general education and technical training.
7. The wages of technicians must be revised upwards forthwith if the universities are to attract the right type of personnel.
8. Centralised technical services and supplies for research should be established in each university. These should include facilities such as a typewriting pool and a statistical service.
9. Departments of Applied Science should be brought into being, as they are bound to play an important part in the university.
10. Industrial development work should be carried out in Research Association laboratories ; but where these Research Associations do not exist the university laboratories may be employed.
11. Academic scientists should be allowed to act as consultants or advisory directors of research to research associations and should be given leave to spend long vacations in industrial laboratories.
12. Properly supervised research in selected Research Associations and Government laboratories should be allowed as part of or a full qualification for a higher degree.

Some of these recommendations involve capital cost and the memorandum referred to above estimates this to be not less than £30 million over a period of ten to twenty years. The actual expenditure of the universities would rise to £15 million per annum within five years and to £20 million over ten years at 1939 values. It has been suggested that most of this money will come from the State. Further, it has been strongly recommended that the Treasury Grant to the Universities should be doubled in the first academic year after the war and increased to quadruple, that is to £9 million, in the fifth year.

The future of Science in the British universities would thus be assured. This must serve as an incentive to our Vice-Chancellors who should ask the nation and Government for more grants for technical education and developments of Sciences in the Indian universities. I have been told that at least in two Universities in India, scientific research is now positively discouraged and (in the name of

economy) admission to research students, in spite of the willingness of the professors concerned, is almost completely prohibited. I take this opportunity of drawing the attention of those who love their country and wish it well to see that the field of University education is kept as free from narrow communalism and politics as possible. Since politics has begun to play a part in the selection and election of Vice-Chancellors, the University standards in India have tended to deteriorate instead of showing an improvement and if these evils are not looked into by the Chancellors and the Courts of the Indian Universities, these institutions will cease to be real seats of learning and will turn into areas for political ambitions.

SCIENCE IN BRITISH INDUSTRY

British industry in the past relied too much on tradition. It is now realised that the prosperity of Britain after the war depend as never before upon the efficiency and progressiveness of her industries. Happily, for it is a most healthy indication of things to come, industrial and scientific research, is on almost everyone's lips now-a-days and it is certain that this will be one of the major features in post-war industry. In certain industries, such as the chemical industry, the application of Science and research has reached such high levels already that even the Department of Scientific and Industrial Research has not considered it an imperative necessity on their part to equip and maintain their Chemical Research Laboratory to the same level of efficiency as their National Physical Laboratory. They maintain that the Imperial Chemical Industries conduct research on such a large and liberal scale that the Government Laboratories need not compete with them. The Directors of the Company are progressive in their views on scientific development and at a luncheon which the I. C. I. gave to the Indian Scientists at Claridges, Lord McGowan, the Chairman, reported that the Directors of the Company had offered to provide at nine Universities of Great Britain, eighty fellowships of the average value of £600 per annum to be held by senior workers in certain Sciences. The research organisation of the Company itself consists of nearly nine hundred fully qualified chemists, physicists, biologists, engineers and other scientific men and more than a thousand skilled assistants. During 1943 its expenditure on research and development in its own work was approximately £2,200,000 ; and in addition, £12,500,000 became due from the Company to the British and Overseas Governments under the heading of Excess Profits Tax, National Defence Contribution and income-tax. We had the good fortune to see their vast factories and research organisations at Billingham, Blackly and Huddersfield, and our distinguished industrialists who are visiting England should go and see these signs of research-mindedness of the British Industries.

When I replied to the toast proposed by Lord McGowan at the luncheon, I spoke of the I. C. I.'s partiality to their own country. They had at least two big factories in India and I pleaded for grants of a generous scale for scholarships for scientific research in India by the I. C. I. I urged that no feast given to the Indian Brahmins is complete without a gift, and that all scientists are Brahmins by profession. The plea went home to Lord McGowan and he promised to consider in a friendly way the question of endowing research fellowships in Indian Universities. He also assured us that the eighty fellowships in the British Universities were open to Indian scientists in free competition.

Besides the I. C. I., there are other industries in Britain which have large research departments, and we were particularly impressed by the efforts which had been made by such firms as Metropolitan Vickers at Trafford Park, Manchester, by the General Electric Company at Wembley, by Burroughs Welcome, by Brown Firth & Co., by the B. T. H. at Rugby and by the Anglo-Iranian and Shell group organisation. In addition to the many private investigations carried out by individual

firms, the interests of research by industry are safe-guarded by investigations carried out in twenty-four Industrial Research Associations, which are maintained jointly by Industry and the Department of Scientific and Industrial Research.

We are aware of even more outstanding organisations of this kind in the U. S. A. and Canada and look forward with eagerness to visiting the Bell Telephone Laboratories in New York in which the American Telegraph and Telephone Company employ over 4,000 scientific workers and technical men. The General Electric Company at Schenectady, N. Y., the Eastman Kodak Company at Rochester, N. Y., the Mellon Research Institute, Pittsburgh, and the various Petroleum Companies in the U. S. A. have fully equipped laboratories which work day and night on problems of fundamental and applied interests.

If Indian industry has to rise, and rise it must to its proper stature in time, it must begin to devote more attention to expenditure on research. There is hardly any industrial organisation in India except Tatas which provides even reasonable facilities for scientific and industrial research. Lately Mr. G. D. Birla and Sir Shri Ram have shown some interest in scientific research, but much has yet to be done by Science to save the existing industries in India from extinction by outside competition after the war.

The newly started industrial units of India should join together and form Industrial Research Associations and the Council of Scientific and Industrial Research and the Government should subsidise the organisations so that they may blossom forth into hopeful industries of the future India.

Now that expenditure on research, both capital and recurring, is likely to be free from the Excess Profits Tax, Indian industry should give a real impetus to Science. Nothing will help industry and science more than if our firms in India become research minded. Even before my visit to England I strongly advocated the formation of Research Associations in India and I am glad to hear that the chemical and pharmaceutical industries of India are about to give a lead in this matter and have apprised the Council of Scientific and Industrial Research of their intention to form a research association. After seeing the work of Research Association Laboratories here, I have become convinced that we must work hard to get our small and big industries in India research-minded so that they may gain knowledge and strength to produce goods of the best quality and performance.

INDUSTRIALISATION OF INDIA ESSENTIAL FOR WORLD PROGRESS

Perhaps the most important factor which will have worldwide implications will be our attempt to raise the standard of living in India. Politics does play an important part in all events. It is obvious that the best and quickest way of bringing about national development is for India to have a National government, representative of the people. The present absence, however, of such a Government does not justify that the thinking men and women of India should not devise ways and means of bettering the lot of their fellow-beings to the best of their ability under present circumstances and in view of the future. I am not convinced that the rich and the wise in the land have done all they can for agricultural and industrial development of India.

It has been urged by some that the problem of India is largely biological ; that health, food and population are our real bottle-necks. Those who know India intimately are fully aware of the facts that attention to agriculture alone cannot solve the problem of India's poverty. Biology must be helped by Physics, Chemistry and Engineering, even by Mathematics. India cannot be healthy, prosperous and self-respecting, and education, medicine, and agriculture cannot play their important role, unless a good bit of India's population is devoted to pursuits other than agricultural.

In a previous paper I have described the orders of priority for some of the industries essential to India's development. In that paper the first place was given by me to the development of power and there seems to be now a general consensus of opinion that India must develop her hydro-electric and other power resources as her coal resources are already severely strained. This project will have to be largely financed by the State, as it is far too big for any private enterprise in India. The State will also have to help big basic industries and heavy engineering. We should, by all methods of persuasion and even threats, appeal to existing industries in India to develop the by-products industries associated with them. For example, the great jute industry in India should take immediate steps to manufacture such things as jute-boards, Brattice cloth, jute felt from jute waste, jute containers and jute cloth for wearing purposes. The State and the public should insist upon these industries being developed by the Jute industry itself. Similarly it should be the duty of the sugar industry that their by-products such as molasses and bagasse should not be used wastefully as at present. Power alcohol furfural and its derivatives, acetic acid and all sorts of plastics and solvents can be made from these by-products and these should occupy the immediate attention of the promoters of our sugar industry. They have sufficient money to invest in these ventures which may not start paying dividends all at once, but they will eventually be all very worthwhile in national planning and development. If I would not be misunderstood, I would make a suggestion to those European and Indian friends who are interested in the industrialisation of India not to fight for less or more to either side, but to come to terms honourable for both and do something to help Indian industry. It is obvious that European friends in India will have to yield to the natural aspirations of India, namely that industry in India should be largely managed by Indians themselves. Indian businessmen should see that co-operation with the allied powers is the quickest method of developing India. The energy spent in fighting may be better spent in cooperative development. If the by product industries of coal distillation, the petroleum industry, the textile industry, the woolen, cotton, sugar and jute industries and the metallurgical and chemical industries are developed, the country will have a different complexion altogether and a coordinated programme of development in all directions will become a possibility. This plea I am entitled to make as President of the Indian Science Congress, as I am convinced that Science has no future in India unless our agriculture and our industries are fully developed ; more food and more health are dependent upon these factors. Scientific and industrial research thrives best when it is applied to material benefit to human kind and to existing industries and existing agricultural enterprise.

LEGISLATION AND SCIENTIFIC AND TECHNICAL PROGRESS

We were invited to a luncheon at the House of Commons by Captain L. Plugge, M. P and were later invited to a meeting by an influential unofficial organisation known as the Parliamentary and Scientific Committee. This body consists of large number of members of both Houses of the British Parliament, together with representatives of many important scientific and technical institutions and societies. It has no official authority but it commands great influence. Its President, Lord Samuel met us at lunch and its Chairman, Mr. E. W. Salt, M. P., presided over the meeting which we attended. It was a great gathering ; Professor A. V. Hill himself, as M. P., introduced the members of the Indian Scientific Mission one by one and each one of us made a short speech on our special subjects. We were subjected to numerous questions of a searching nature and the Chairman assured us that, through their influence in Parliament, they will advocate the cause of scientific and industrial research and development in India. It is my considered opinion that the members of the Council

of State and Assembly in India could well form such an organisation as the Parliamentary and Scientific Committee. This would keep them in touch with all the problems of modern interest such as technology, science, agriculture, food and health. They could help by talking over matters with Honourable Members privately or by asking questions on the floors of the two Houses. Such an organisation would enable our legislators to take an intelligent interest in the terrific task of reconstruction which faces our country. This would also lead them to appreciate the special role of scientific men in modern society.

TRAINING OF PERSONNEL

As a result of our visit it may be possible to persuade the Government to have scientific liaison offices in Washington and London, and possibly Moscow, so that the Indian scientists and the Indian Government departments may be in touch with the rapid strides which Science and technology are making in these countries. These offices will have to be staffed by scientific men of some standing in India. It is also likely that we may be able to get admission for a large number of scholars and technicians from India both in the Universities and industries. We found many Universities eager to have good students for postgraduate studies. Lord Eustance Percy was particulary anxious that good-class Indian students should take advantage of medical and dental studies in their well-equipped faculty of medicine at Newcastle. Similar assurances were given to us by the authorities of Cambridge, Oxford, London, Sheffield, Leeds, Glasgow and Manchester Universities. There will be a great paucity of space immediately after the war in these places of learning, but they hope to have a great deal more space later on. We should increase the availability of technical talent in India by sending our young and brilliant students to England and America. India needs not only scientific researchers but also technicians—persons of the foreman type who can help in the running and repairs of machinery so essential for industrialisation. Such firms as the Imperial Chemical Industries, Metropolitan Vickers and the non-ferrous metal industries in England are quite willing to train young men from India and even pay them as apprentices ; we need a very large number of men with these qualifications, and we shall have to look for such training in Canada and the U. S. A. as well.

FACTORY AND FARM

In England great emphasis is being laid on equalising the standard of life in the cities and the villages. Agriculture still retains in England too much of its primitive character. Modern methods of application of energy on the farms, conditioned transport and proper storage of agricultural produce are still in their infancy. Canada and the United States are ahead in this field and the tractor, the motor vehicle and electric power have contributed a great deal in those countries for a better standard of life on the farm. On a value basis at present about 88% of the world's agricultural produce is used as food, 8% as textiles and 4% for other industrial purpose. The last two together form roughly one-third of the raw materials of industry. There is an increasing tendency to look to agriculture for a larger proportion of these raw materials, but these materials can only be used profitably if the factory becomes an adjunct of the farm. Industry is moving towards the ideal particularly in the U. S. A., and this may be a lesson which we in India may learn in our planning for the future. We are so primitive in our farming that this would be an idle dream unless we first improved our transport and communications and provided better methods of storage and marketing, power-driven machinery and the use of proved fertilisers.

After studying the great strides which Science has made in England, we are expecting to visit the U. S. A. and Canada. As a young boy, my

classmates used to tease me for being a day-dreamer. I used to think of great things which Science could do for India and the part I, myself, should play in it with the rest of my friends. The improbabilities of my dreams coming true used to be the principal subject of jokes when I was a student. If I had not possessed a sense of humour and had taken those jests seriously I should have been a physical wreck. But, God be thanked, I have survived to see some of my dreams fulfilled. Failures have been many and successes rather few, but with an inborn optimism and faith in my country's future I pursue on. We shall now go from Billingham, Leeds, Sheffield, Coventry, Lancashire, from the Royal Society of London and from our beloved Hill and Dale to the lands of Niagara Falls, the Boulder Dam and the Tenessee Valley. The tale of the Tennessee Valley is the romance of a wandering and inconstant river, now become a chain of charming and lovely lakes which have contributed much to the enjoyment of life of the people, on which move, without any dangers of accidents, barges of commerce which nourish American industries. It is a fairy story of wild waters controlled by human ingenuity creating electrical energy which has been America's Aladins lamp.

I dream of the Tennessee Valley, but not without hope ; for all this may happen to any river valley in India, to the Damodar, to the Ganges, to the Sutlej, to the Nurbudda, to the Sone ; if the people and the Government just give science a chance.

MACHINE VISION : AN UPCOMING REALM

Mandeep Singh, Guneet Kaur, Sukhbir Kaur*

Automation means replacing human beings by machines to the extent technically feasible. Till recently, the work of visual inspection was done by human workers, thereby decreasing the speed, reliability, productivity and predictability of quality of the entire chain. A new field of machine vision that imparts power of "seeing" to machines has now overcome this problem too. This paper discusses briefly this subject of machine vision and its varied applications in different fields.

INTRODUCTION

An old age saying is Seeing is Believing. Perhaps, till recently, capability to see was what made humans distinctly superior to machines. Nowadays, we have this sense of vision available in many machines which are used in day-to-day activities and this is no longer a subject of science fiction. It is anticipated that very soon we shall have machines that can recognize human face and allow only the authentic owner to have access to his gadgets, equipments, vehicles, etc. But what has already been achieved in this upcoming area of machine vision includes automatic visual inspection of finished products in assembly line like picture tubes, electronic circuits, mechanical brackets ; dose control of weedicides by visually sensing the presence of weed in the field ; automatic sorting of vegetables and fruits by their shape and size ; traffic control by visually sensing the actual traffic on the road ; guide map for the user to go to vacant parking slot in multistoried parking and so on. The list is very long but surprisingly, common man has little idea of these developments. In the subsequent sections we shall be discussing some technical details of this upcoming field.

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WHAT IS MACHINE VISION ?

Machine vision has been defined by the Machine Vision Association of the Society of Manufacturing Engineers and the Automated Imaging Association as the use of devices for optical, non-contact sensing to automatically receive and interpret an image of a real scene in order to obtain information and/or control machines or process[1]. Basically machine vision comprises two processes :

(i) Image processing and (ii) Image analysis.

Sometimes, the image acquired by cameras or other devices are not in the form to be used directly. These may need improvement to reduce noise or to be enhanced, altered, segmented or filtered. Image processing therefore, is a collection of routines and techniques that prepare the image for further analysis by enhancing the image. On the other hand, image analysis is a collection of processes to extract the imformation from the captured image, which is prepared by image processing tools and techniques[2].

HOW MACHINE VISION WORKS ?

Machine vision is a merger of sensing techniques and computer technology. The system consists of both hardware and software components. The basic hardware components are light source, solid state camera (lens) and vision processor, while the software consists of digital image processing and analysis.

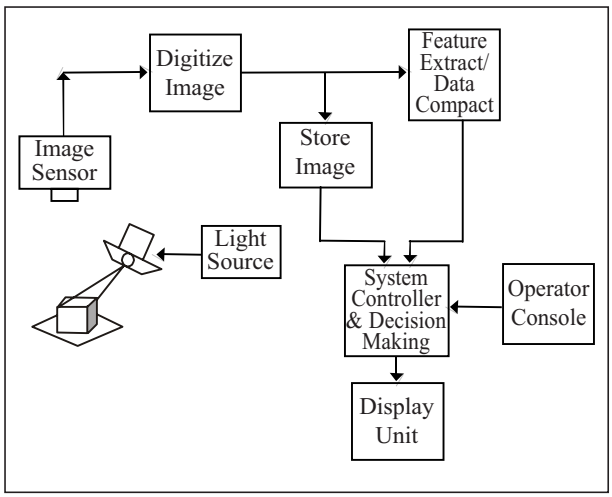

Fig. 1 *Functional Block Diagram of Basic Machine Vision System*

(a) ***Light Source*** : While capturing the image, the crucial part is the lighting conditions. Light can be ambient or artificial but we should avoid using ambient light as the intensity and direction of light varies from dawn to dusk. The various types of light sources may be used as an improvement over ambient lighting conditions. For high contrast between object and background, spectral conditions need to be taken into account.

(b) ***Camera (Image Sensor)*** : Camera is used to capture image of any desired field or moving object. The camera should be able to grab the image at a fast rate so that we do not lose any information about the object. Image capture and digitization unit thus, should have capability of capturing the image in one frame time. The object's area and its distance from the camera affect its resolution. Cameras can be analog or digital. Nowadays, digital and CCD (Charge Coupled Device) cameras are used in machine vision systems.

(c) ***Image Digitization*** : If the analog camera is used to capture image, the analog-to-digital converters are required to make the image in digital form. Digital image comprises small picture cells, usually called pixels. Intensity and colour in each pixel varies to create an image.

(d) ***Image Storage*** : The most common formats used for image storage are Bitmap (BMP), Data compressed Joint Picture Expert Group (JPG) and Graphics Interface Format (GIF)[3]. Digital storage can be used for three purposes : (i) Short term storage for use during processing using frame buffers in computer memory. (ii) Online storage for relatively fast record using magnetic tapes. (iii) Archival storage for infrequent access using magnetic tapes and optical disks.

(e) ***Image processing*** : To enhance and improve the acquired image for further analysis, various processing algorithms are used. Image processing is not meant for extracting information from the image but for removal of faults like noise, blurring of image etc. Suppose the image obtained becomes blurred due to motion of the object. This blurring needs to be removed by image processing tools, before extracting any information about this object. The various image processing tools used for image enhancement are Dilation, Erosion, Threshold, Close, Open, etc.[2]

Dilation : Increase the brightness of each pixel surrounded by neighbors with a higher intensity. **Erosion** : Reduces the brightness of pixels that are surrounded by neighbors with a lower intensity. **Threshold** : Converts the gray scale image into binary image. **Close** : Removes dark spots isolated in bright regions and smoothes boundaries. **Open** : Removes bright spots isolated in dark regins and smoothes boundaries.

(f) ***Image Analysis*** *:* Various operations and techniques are applied to the processed image to extract the desired information. Among these operations and techniques are : Object recognition ; Feature extraction ; Analysis of position, size, orientation, etc. these terms being self explanatory in nature.

(g) ***Display Unit*** : Screen of computers or laptops are usually used for display purposes. Sometimes, storage of captured images is also done within the computer for offline analysis.

MACHINE VISION VS. HUMAN VISION

Human vision system consists of not only a pair of eyes, but also optical nerve that is indirectly connected to occipital region of the brain. Brain possesses 10^{10} cells (neurons), which are interconnected with each other and each cell in itself is a microprocessor i.e. we have an immense processing elements operating concurrently. We need a large parallel processing system to replace the human vision system. Probably, the largest single man-made computer still contains less than 100 million processing elements[4]. The majority of visual and mental processing tasks that eye-brain system can perform instantaneously have no chance of being performed by present day man-made system. With the ever increasing development in computer hardware resulting in its enhanced speed, we are on the verge of generation of machines that will approach visual system's capabilities.

Comparison on the basis of capabilities :

- Human vision is a parallel processor, whereas machine vision is a serial processor.
- Humans have the capability of 3-D image acquisition and interpretation while machine vision is highly developed in the area of 2-D image interpretation, with limited capabilities in the field of 3-D image field.
- Human vision interprets color based on spectral response of photoreceptors, while machine vision is a gray scale interpreter based on spectral response of sensor.
- As the sensor is used to acquire image in case of machine vision, its range is much beyond the range of human vision.
- Motion of object leads to blurring of image in case of machine vision, whereas it is not the case with human vision, as eye is too fast that it can capture 30 images in 1 second.
- Human vision is qualitative and subjective while machine vision is quantitative.
- In machine vision high contrast images are required for detection of edges/regions, but no such requirement is there in human vision.
- Proper hardware and software is required in machine vision, no such kind of requirement is there in human vision[1].

Comparison on the basis of performance

- Machine vision is used for automation of processes because it is best for high production volumes, but human vision is best at low or moderate production volumes.
- Machine vision resolution is limited by pixel array size, whereas human vision has high resolution capability.
- Processing speed in case of machine vision is fraction of second per image but human vision has real time processing speed.
- As compared to human vision, operating cost of machine vision is high for low production volumes and lower for high volumes.
- Machine vision is accurate for part discrimination based on quantitative differences whereas human vision distinguishes quality accurately[1].

MACHINE VISION APPLICATIONS

By now, it must be clear that machine vision mainly started with the objective of replacing visual inspection tasks so far assigned to humans. Machine vision therefore finds applications in diverse fields ranging from space exploration to vegetable sorting. The applications are briefly tabulated below :

The above table is only illustrative of the applications and is not an all inclusive list, which is growing at an unimaginable rate.

Industrial automation and image processing	Process control, quality control, geometricalmeasurement[5]
	Barcode and package label reading, Object sorting
	Parts identification on assembly lines, defect and fault inspection[5]
	Inspection of printed circuit boards and integrated circuits[4]
Medical image analysis	Tumor detection, measurement of size and shape of internal organs, blood cell count[5]
	X-ray inspection[4]
Robotics	Obstacle avoidance by recognition and interpretation of objects in a scene Collision avoidance, Machining monitoring[6]
	Hazard determination
Radar imaging	Target detection and identification, guidance of helicopters and aircrafts in landing, guidance of remote piloted vehicles (RPV), guiding missiles and satellites from visual cues[5]
Food industry	Sorting of vegetables and fruits, location of defects e.g. location of dark contaminants and insects in cereals[4]
Document analysis	Handwritten character recognition, layout recognition, graphics recognition[7]

CONCLUSION

With the advent of machine vision technology, a revolution has come in the field of automation. Automating an operation in a manufacturing plant requires a high degree of pre-installation systems engineering and post-installation process integration. The use of machine vision technology in manufacturing can be as simple as producing an inspection quality report or as complex as total process automation. At the end, we can say that machine vision is a powerful tool of automation that includes both image processing and image analysis tools.

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DO YOU KNOW ?

Q1. In which planet the duration of the day is close to that on our earth ?

Q2. What is the total number of cells in human body ?

FOG WATER HARVESTING

Arun K. Pandey*, Sanjeev K. Srivastava & K. K. Tiwari**

Fog water harvesting can make a significant impact on the quality of life of the people living in the water scarce area and, if sufficient collectors will be erected, the water can be used to start various small scale agricultural projects. With sufficient water, the abundance of sunshine and the absence of other natural hazards such as hail and frost, the selection of appropriate crops can generate a substantial income and significantly improve the quality of life of the community.

INTRODUCTION

Manany countries in the world are facing water security and scarcity problems. The rapid population growth and increasing pollution of rivers and ground water have put much stress on the water resources to meet the needs of the teaming millions. India is blessed with vast water resources. The sustainability of the water resources has gained increased importance, as scarcity has already started being felt in some parts of the country. Therefore, the sustainable management of water resources has been emphasized equally with creation of new facilities.

There is an urgent need to conserve fresh water, either being polluted or wasted to the rivers, oceans or on land. Collecting rain-water on roofs (urban areas) and in well planned watersheds (rural areas) are very common and ancient practices in India. But, in the time of new challenges, it's necessary to collect water from its each and every source, even from smaller sources like fog and dew.

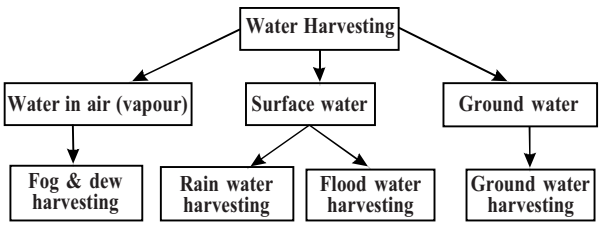

Fig. 1 : Types of water harvesting

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Fog water harvesting (FWH) offers an untapped resource of water to the society for various applications, particularly over the plains in northern India, which experience dense, widespread and prolonged foggy days in winter. Under specific atmospheric conditions, fog and dew can be captured and yield substantial amount of water which can be used for domestic purposes, livestock, establishment of trees, or for the growth of crops. Small and simple installations or the condensation of fog and dew can yield several liters of water per day.

WHAT IS FOG ?

Fog is defined as almost microscopically small droplets of water (condensed form) and suspended in air near the surface of earth in sufficient number to reduce the horizontal visibility to less than 1 km. In simple words it's a cloud with its base at or very near the ground is provoked by the following conditions :—

- Substantial heating during the daytime.
- Clear skies or very light high clouds at night.
- No or very light wind.
- Thermal inversion at moderate heights.
- A sufficiently high atmospheric humidity (so it's more common in the vicinity of ocean where there is an abundant supply of moisture near the earth surface than inland).

Fog formation takes place on a synophilic scale;

however its characteristic may change over regional to localized scales depending upon terrain effects, urban and non-urban regional availability of water bodies, wet surfaces, etc.

HISTORY OF FOG WATER HARVESTING

Fog though an alternative source of potable water is largely ignored, it was used extensively in the ancient times. Palestinians for instance, build small low circular honeycombed walls around their vines. So that, mist and dew can precipitate in immediate variety of plants. Historically, both dew and fog were collected in the Atacama and other deserts from piles of stones, arranged so that the condensation would drop to the inside of the base of pile where it shielded from the sunshine. In the Canary Islands, fog drip from trees was a sole source of surface water for man and animals for many years.

A number of projects have been mutated which specifically aimed at supplying fog water to communities. In this direction, the efforts are already on in many countries like Chilly, Peru, Oman and Nepal. The first was implemented at Mariepstop in Mpumalanaga, South Africa during 1969-70. The second and largest fog collection project to date was initiated by researchers at the National Catholic University of Chile and the International Development Research Center in Canada, at a small fishing village in northern Chile in 1987.

Though, plains in northern India, experiences dense, widespread and prolonged foggy days in winter, no such study has been done. Only a few efforts have been made in the country. In a study it has been estimated that during January, 2003, the maximum suspended water available in fog was about 12.5 billion liters over India.

FOG CHARACTERISTICS

Occurrence of fog is not uniform. It varies over space and time. Annual fog incidence decreases with increasing latitude and longitude. It means fog occurs more frequently at sites with a slightly higher elevation than sea level.

Fog occurs more often during the cooler nocturnal hours peaking between midnight and 8.00 a.m. and confined to the period of midnight. Fog intensity is the most considerable character of fog. It can be determined by the degree of visibility in fog, which further depends upon the opacity of the air, resulting from the number of particles held in the suspension. It is defined as, "the greatest distance at which a dark object can be seen".

The mean annual fog day frequencies were recorded as 66 days/year at Dassen Island ; 111 days/year at Cape Columtine and 148 days/year at Port Molloh. In India, not only the hilly regions, most of the northern plain of the country like Delhi, U. P, M. P. and Bihar faces more than 40 dense foggy days/year, which offers the scientists to collect water.

FOG COLLECTORS

Fog droplets are much smaller than both raindrops and drizzle drops with diameters varying from 01 to 40 microns and fall at velocities ranging from less than 01 cm/s to about 05 cm/s. These low velocities result in fog droplets being influenced even by light winds that can cause the droplets to travel almost horizontally. Therefore, such surfaces are constructed as vertical mesh panels on which fog droplets are intercepted and collected.

A full-scale fog collection system consists of simple, rectangular nets supported by a post at either end, arranged perpendicular to the direction of wind (**Fig. 2**). These surface-nets are usually made up of nylon or polypropylene netting (usually has an extraction of 30%). An anemometer is attached with the pannel to know the wind direction (**Fig. 3**). As water condenses, it falls to a collector,

which conveys the water to a storage tank (**Fig. 4**) where the water can be filtered, chlorinated and distributed.

Fig. 2 : A fog harvester arranged in perpendicular direction of wind can condense fog into water

Fig. 3 : Fog collector with anemometer to detect the wind direction

Fig. 4 : A storage tank attached with the fog harvesters

Fig. 5 : A close view of nylon made fog collector

COST AND OPERATION

Cost of the fog-collector panel is not very high. Virtually all of the input materials to construct, operate and maintain the systems are available locally, thus, cost differs from place to place. However, an automatic weather station costs about $50,000 to purchase and install. Operations requirement include the measurement of volume collected and the recording of meteorological data, either manually or by automatic weather station since changes in weather conditions may change the operational design of harvesters.

EFFECTIVENESS OF TECHNOLOGY

Also no intensive, permanent structures are nessessary to implement this technology and the derived water is normally potable. The technology can easily cater to the water need of coastal or desert settlements or camps currently relying on saline water sources or some other expensive options such as desalinization and tanker delivery. The water is available within the demand area and therefore, requires little or no pumping. The water source is also sustainable for many years. The collectors are simple and require no energy other than the wind. Thus, there will be no pollution during its operation.

A surface area of about 50 m^2 can harvest a significant amount of fog and convert it into water. Fog harvesting is suitable in regions which have hills or mountains close to potential users, on a

coastline with an old current offshore. The quantity of derived water is a function of scale of project and fog unavailable. There is a chance of contamination of dust, microbes and other pollutants present in atmosphere. In Namibia, the resulting water is slightly salty as a result of the inclusion of some marine aerosols and contains some dust. Due to highly stable atmosphere, the pollutants released locally, cannot be transported to other place by wind easily. However, many of such pollutants can be removed using a simple sand-filter. Their complete removal needs more sophisticated technical tools which further increase the cost of the project.

CONCLUSION

All countries need to join their scientific and financial resources to help fight the world water crises before it encompasses the entire world. It is hard to imagine that water, something so basic, so simple and so necessary is at risk of elimination.

Thus, there is an urgent need to study the benefits and drawbacks seriously in Indian context before installation of fog-collectors. Due to sufficient foggy days and other atmospheric conditions, this technique will certainly be suited to us.

DO YOU KNOW ?

Q3. How much cosmic dust falls on Earth from space each year (meteorites and cometary dust) ?

Q4. How many motions does earth have ?

LIGNOCELLULOSE BIOTECHNOLOGY : HARNESSING RENEWABLE PLANT MATERIALS FOR ENERGY AND CHEMICALS

Naveen Kango*

Rapid depletion of finite fossile fuel resources and ever increasing energy demands have initiated search for novel alternatives. Lignocellulose is a cheap, abundant and rapidly renewable resource that awaits wise and judicious utilization for generation of energy, chemicals and other useful commodities. The development of a cost-effective bioprocess for utilization of lignocellulosic biomass will be a dependable step towards sustainability and a significent solution for energy crisis.

INTRODUCTION

Apart from food and feed, plants have contributed to paper industry, adhesives, boards, additives and drugs. Recent advents in research indicate that lignocellulose biotechnology is about to open novel vistas in producing biofuel, chemicals and other bio-based products for a sustainable future[1,2]. While energy demand is growing rapidly, non-renewable fossil fuel reserves are limited. The global crude oil production is predicted to decline sharply in the coming years. It is a certainty that fuel crisis is going to be a major problem in rapidly developing India and rest of the world. Realising this, several nations have initiated exploring alternatives based on lignocellulosic biomass (biofuel, biodiesel). The idea is to replace or supplement fossil fuels with these non-conventional fuels derived from rapidly renewable plant produce. Moreover, use of biofuel is also indicated to be a clean-green solution for the problem of heaving anthropogenic gas emissions due to use of fossil fuels. Low value lignocelluloses are looked upon as substrate of choice that awaits judicious utilization. Complex and diverse lignocelluloses can also be used as a good source of chemicals and starting materials for bioprocess to produce industrial enzymes. India being a giant agricultural economy produces enormous amounts of lignocellulosic low-value biomass. At present this biomass is burnt or disposed off indiscriminately causing environmental problems. The bottleneck of this endeavour is cost effectiveness owing to large share of cost incurred towards the process of lignocellulose hydrolysis and its bioconversion. The present article discusses application of lignocellulose biotechnology for production of assorted range of products including biofuel, chemicals, enzymes, food and feed additives, etc.

LIGNOCELLULOSES

Lignocellulose, consisting of lignin, cellulose and hemicelluloses, makes major structural component of woody and non-woody plants. It is complex, diverse and rapidly renewable. Its chemical composition and aptness for enzymic hydrolyis make it a substrate of immense biotechnological importance. Large amounts of lignocellulosic by-products of low value are

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generated through agriculture, forestry, timber and other agro-industries. However, in the absence of any suitable technology for its judicious utilization, it is being disposed off or burnt indiscriminately. This leads to environmental pollution and problems of solid waste disposal. An effective technology for generation of value added products from lignocelluloses augments benefits of waste disposal as well. Lignocelluloses are potential candidate for generation of several value added products including biofuel (ethanol, biodiesel), substrates for fermentation for production of SCP, enzyme, chemicals, food and fodder, etc. More importantly, crude lignocelluloses viz. corn cobs, wheat bran, wood shavings, etc. have proven to be an excellent substrate for solid state fermentation. Lignocellulosic biomass includes all kinds of materials that emerge out of forestry and agricultural practices eg. thrashing, harvesting, timber and plywood industries alongwith aquatic and marine plants and municipal wastes.

SACCHARIFICATION

Saccharification of lignocellulosic biomass such as agricultural residues, woody biomass, hemicelluosic waste from municipal and industrial sources, provides a competent method of yielding sugar syrups. Sugars can be further utilized for supplementation of animal or human diets or can be used in fermentation industries for microbial growth. This involves mild physical pretreatments and application of several glycosidases, cellulases and xylanases being the important ones. Microorganisms elaborating consortia of such microbial enzymes are of utmost importance here whereas enzymes with flexible specificities serve better for total saccharification of biomass[3].

BIOFUEL

Ethanol which is generated for the specific purpose of use in automobiles as an octane enhancer or petrol supplement is referred as biofuel. Efforts are being made to develop a cost-effective technology for generation of biofuel ethanol from lignocelluloses. In several countries, including USA and Brazil, biofuel ethanol has been used for blending and oxygenation of conventional fuels (Gasohol).

The biomass used for generation of biofuel ethanol includes mainly maize with small inputs from sorghum and other crops. To make the production cost-effective and economically viable, an integrated approach of pretreatment, bioprocess engineering and recovery method is needed[4]. Lignocellulose being a complex material, the current thrust is on development of an efficient hydrolysis and conversion technologies. The process involves mild pretreatment, enzymic hydrolysis and fermentation. Bioethanol production from wood through acid hydrolysis needs detoxification of the hydrolyasate for achieving good yield. Recently workers have emphasized on manipulation and change in feedstock for higher fermentation yield. It has been observed that there are genetic elements that can be targeted and manipulated to evolve crop plants with more suitable lignocellulose for biofuel generation. The current trend includes optimization of feedstock alongwith development of high-efficiency microbial conversion bioprocesses. With the hydrolysis of lignocellulosic components, some inhibitors and undesirable lignin are also liberated. These affect the bioprocess adversely and can bring it to a halt. Solution lies either in selective removal of inhibitors or use of robust enzymes/microorganisms that are resistant. Researchers are also exploring down-regulation of lignin biosynthesis in plants. Production and use of Bio-diesel (methyl esters of plant fatty acids) from plants such as soybeans, Jatropha (commonly known as Ratanjot) has taken some strides but is limited by the current overall economics.

CHEMICALS AND OTHERS VALUE ADDED PRODUCTS

Soon rapidly renewable resources such as biomass will be sought after by the chemical industry. In the perspective of white biotechnology, this will be junction point of agriculture and the chemical industry. Bioconversion of lignocelluloses can contribute enormously to the production of organic chemicals in an eco-friendly manner. The components of biomass can be hydrolysed to produce base-chemicals and aromatic compounds or the hydrolysate can be fermented using suitable microorganisms to produce value-added commodities such as methane, antibiotics, sweeteners (Xylitol), furfural, lactic acid and benzene. Vanillin, a flavoring agent (*Vanilla*) in food and pharmaceuticals can be derived from lignin containing liqours of other industries. A recent approach of linking up biotechnological and chemical processes for lignocellulosic conversion is setting up of Bio-refineries which combine the necessary technologies between chemical hydrolysis, bioprocessing of biological raw materials, industrial intermediates and final products[5].

FERMENTATION

Literature indicates that much interest is being taken in identifying cheap alternative substrates for their use as an alternative to costly chemicals in fermentation processes. The idea is to make process cost-effective by reducing the cost input of media ingredients. Reports suggest successful use of sugarcane bagasse, corn cobs, wheat bran, wood shavings, molasses, etc. in microbial fermentations[6]. Basically, all these are low-value lignocelluloses of plant origin and by-products of different industries. For any particular bioprocess, the choice of substrate primarily depends upon its chemical composition eg. a substrate rich in xylan will be useful for xylanase production, while it should not have much of other reducing sugars which can repress xylanase synthesis. In nature, a number of microorganisms colonize and grow on decaying lignocellulosic matter. These microbes have inherent ability to decompose one ore more lignocellulosic components (lignin, cellulose and hemicelluloses) and utilize it for their nutrition. In most cases these organisms elaborate enzymes that degrade lignocellulosic components into simpler, utilizable units. The ability of these microbes can be utilized *in vitro* for achieving specific objectives such as cellulose hydrolysis to produce glucose. The hydrolysate rich in fermentable sugars is further used as a substrate for other bioprocess e.g.

Table 1 : Components of lignocellulosic biomass and hydrolyzing enzymes

Component	Hydrolyzing enzymes	Utilizable products
Lignin	Ligninase Lignin peroxidase (EC 1.11.1.14) Manganese peroxidase (EC 1.11.1.13.) Laccase (EC 1.10.3.2)	Benzene and phenolic compounds
Cellulose	Cellulases (EC 3.2.1.4) Cellobiase (EC.3.2.1.21)	Glucose
Hemicelluloses **Xylan**	Xylanase (EC 3.2.8.1) β-xylosidases (EC 3.2.1.37)	Xylose
Mannan	β-mannanase (EC 3.2. 1.78)	Mannose
Arbinan	Arbinase (EC 3.2. 1.99)	Arabinose

ethanolic fermentation. Efforts are being made to develop bioprocesses to produce existing products more cost-effectively by selection of suitable raw materials and robust microorganism, lower investment costs and operational costs. One such approach is consolidated bioprocessing (CBP) of cellulose for biofuel production involving cellulase production, cellulose hydrolysis and fermentation

in a single step. CBP needs either naturally occuring or genetically engineered[7] robust microorganisms with high yield and titer of enzymes[8]. The maximal utilization of biomass hydrolysate can be achieved by developing versatile bugs that can co-ferment[9] more than one sugar alongwith glucose eg. xylose, mannose.

CONCLUSION

The ever increasing energy crisis has triggered major efforts in exploring non-conventional renewable resources. Once believed to be almost a waste, the lignocellulosic biomass, now is looked upon as a rapidly renewable source of energy. The technology of bioconversion is still tracking down feasibility since the costs of enzymes and infrastructural setup are large. However, the issue of bioconversion should be pursued with a notion in mind that the fossil reserves are rapidly depleting and some time later it won't be a matter of cost but a compulsive *Alternative Fuel*.

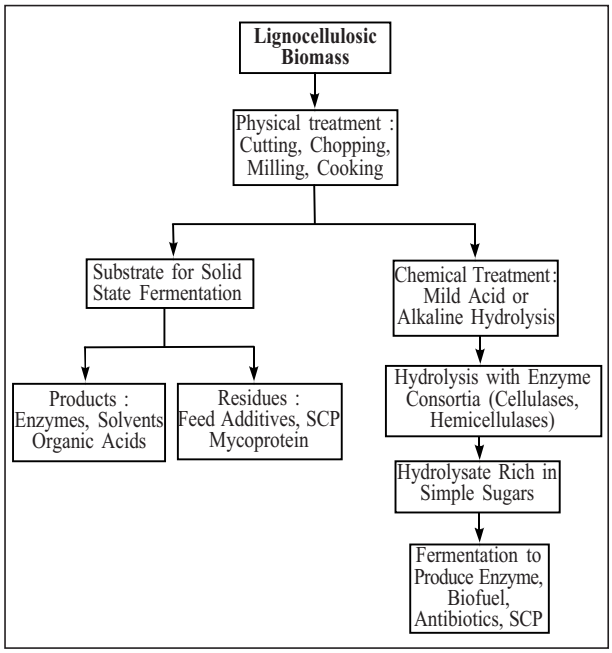

Fig.1. *Utilization of lignocellulosic biomass to yield value added products by fermentation.*

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DO YOU KNOW ?

Q5. What is the minimum velocity required for spacecraft sent to the Moon ?

Q6. How hot is the inside of the earth ?

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TOTAL INDOOR REARING OF THE TASAR SILKWORM

G. Shamitha*

Tasar culture is a forest-based industry best suited to the economy and social structure of developing countries like India. Most significant features are minimum investment required, high employment and high export potential. *Antheraea mylitta* Drury (Andhra local ecorace), besides its superior commercial qualities is on the verge of extinction due to certain natural inadequacies. Domestication of tasar silkworm, which is totally wild in nature is the major area identified to conserve, stabilize and rejuvenate the ecorace. Based on the present study, it is concluded that this ecorace, though well adapted in the forest ecosystem, is not averse to total indoor rearing. Most of the parameters tested were found to be superior in the outdoor reared worms. However, the findings show a reduction in larval mortality during all the three crop seasons, better ERR and Denier in the indoor rearing, and biochemical results on par with the outdoor rearing. This paves the way for a common breeding programme and hybridization to evolve a more compatible and commercially viable race.

INTRODUCTION

Silk is the natural fibre that spells splendour, lustre and elegance and it has been an inseparable part of Indian culture and tradition, over thousands of years. Through the ages, Indian silks have been known for their lustrous sheen, translucent finishes, intricate weaves and rich colours. In India, export of raw silk was reported dating back to 58 B. C. India, being the natural abode of mulberry and four kinds of non-mulberry silks (Tropical tasar, Oak tasar, Eri and Muga) exports silk goods to over 80 countries. There is an urgent need to tap the potential of unexplored area of 'tasar culture' which brings about an economic upliftment of rural populace, especially among the tribals in the years to come.

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The word "Tasar" was derived from Sanskrit literature, and tasar silk was mentioned in 1590 B. C. There are various genii of family Saturnidae, to which tasar silkworm belongs, like, *Antheraea hubner* (Oriental region), *Antheraea pernyi* (China, Japan and U. S. S. R.), *Antheraea yamamai* (Japan), *Antheraea proylei* (Indian temperate tasar variety) and *Antheraea mylitta* Drury (Indian tropical tasar variety).

The present work is an effort towards the improvement of rearing practices of the tasar silkworm, *Antheraea mylitta* Druary, which is the most interesting wild sericigenous insect giving good and lustrous silk filament. This silkworm primarily feeds on *Terminalia arjuna*, the wonder arjun tree of India. This tree is the backbone of Tasar industry and is also used as fodder, in medicine, leather, firewood, paper, soap, locomotive, timber industries and in oil drilling.

Andhra local ecorace of *A. mylitta*, a race confined to the state of Andhra Pradesh since the time immemorial, is well known for its superior quality[1] of silk, hard and compact cocoons, high reelability (69%), high shell ratio (16.8) and low Denier (7%). Now it is on the verge of extinction due to certain weaknesses like irregular hatching of the eggs, moth emergence, weak voltinism and climatic hazards[2]. The development of this ecorace could not keep pace resulting in low productivity and thorough negligence. There is an urgent need for the protection and conservation of this race.

There is a dearth of appropriate technologies especially in post cocoon sector and marketing facilities. In the post cocoon stage, this race suffers certain drawbacks like lack of uniformity in cocoon structure, silk deposition and cocoon boiling due to their hardness and these account for 50% silk loss in spinning.

The low yield of Andhra local (575 gms/1000 cocoons) has given way for the introduction of exotic races like *Sukinda* of Bihar and Orissa and *Raily* of Madhya Pradesh which yields 900-1400 gms/1000 cocoons, which is responsible for the decline of the Andhra local ecorace.

The problems and constraints of tasar silk industry require special attention, since tasar is quite different. Rearing being outdoors, there is a certain extent of crop loss due to prarasites, virus, pests, predators and vagaries of nature affecting the yield of cocoons. Other factors include long larval duration, irregular hatching and limitations in reelability percent, marketing of tasar cocoons, yearn and fabrics which are unorganized sectors in tasar[3].

In order to stabilize tasar silk production, tasar silkworm rearing methods need considerable improvement. As outdoor rearing of wild silkworm predisposes the larvae to the vagaries of climate and vulnerability to pests and predators, a surer way of preventing silkworm crop loss is to conduct indoor rearing of the wild silkworm. Hence several attempts have been made in this direction in the line of *Bombyx mori*, mulberry silkworm, a multivoltine and indoor reared worm, which was also a wild variety some centuries back.

EARLIER EFFORTS OF INDOOR REARING

Earlier, several attempts were made to conduct indoor rearing of tasar silkworm. National Institution of Sericultural and Entomologial Sciences, Japan[4] have developed some artificial diet for tropical tasar silkworm containing Asan leaf powder, the principal food plant, and has achieved success to some extent.

The young age worms or 'Chawki worms' suffer extensive damage due to predators as cited above. 'Chawki worm rearing' was adopted in order to prevent early stage larval loss, which has resulted in 20% increase in Effective Rate of Rearing[5].

Several attempts are made for biological control of tasar silkworm predators[6]. Efforts are also made to prevent high pupal mortality[7] by preserving the cocoons at 10-12°C over a period of three months which reduced erratic emergence and pupal mortality.

In the present investigation, an attempt has been made for total indoor rearing of *A. mylitta.* D (Andhra local ecorace) in which rearing of silkworms has been undertaken from brushing stage to the cocooning stage in the controlled conditions for the three crops, i.e., June to December in the laboratory of Sericulture Unit, Kakatiya University, Warangal, A. P. Simultaneously, outdoor rearing was also done in the field of *T. arjuna* plantation attached to the lab.

A detailed comparative account was made on the performance of both indoor and outdoor rearings on the physical, physiological and post-cocoon parameters of larva, pupa, cocoon and moth.

METHODOLOGY

The new method of indoor rearing evolved here does not involve any sophisticated machines nor power and can be practiced without much investment. In this attempt, a simpler way of feeding has been adopted. The rearing equipment is very simple and is easily available for the farmers who are the first benefactors of this experiment (Fig. 1).

Fig.1. *Total Indoor Rearing Set-up.*

The rearing set has four to five conical flasks or wide mouthed bottles (rather, any water containers which can ensure constant water supply to the branches) kept in a plastic tray (gunny cloth or paper can also be used) as faecal pellets fall constantly during rearing.

A thermocol or a hard-bound sheet having openings of same number as that of flasks used is kept in such a way, that the necks of all bottles exactly fit into them. A paper or paraffin sheet is covered on the thermocol sheet in the same way. This is used to collect the faecal pellets and to maintain cleanliness and healthy atmosphere in the rearing set-up.

The set of water flasks, thermocol sheet on a tray is kept on a table for convenience and easy handling. The rearing room conditions include proper ventilation, room temperature of 25-30°C and relative humidity of 60-70%.

As young larvae prefer tender and juicy leaves, new branches of the pruned plants of equal size are cut and kept in the water containing conical flasks, the late age worms prefer branches with mature leaves.

PRECAUTIONS

Ant wells, filled with water, are used under the four legs of the rearing table to prevent the crawling of ants. Bleaching powder or a cloth dipped in kerosene are used as disinfectants and kept around the rearing set up and near the legs of the table to prevent entry of any other insects.

Everyday during rearing, the branches are replaced with fresh ones, the paraffin paper is cleared off the faecal pellets (bed cleaning), the dead and diseased worms are buried far away from the rearing room. This process is repeated till cocoon harvesting. Care should be taken not to disturb the worms during moulting.

RESULTS AND DISCUSSION

From the results **(Table 1)** it is clear that mortality is less in indoor rearing method than that of outdoor rearing by 7.2, 15.6 and 22.8 percent in

Table–1 : Mortality of ourdoor and indoor reared Tasar silkworm Antherea mylitta. D. (Andhra local) for 250 larvae in each crop :

Instar / Crop	First		Second		Third		Fourth		Fifth		Total		Percent of Mortality		Percent Difference
	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	
I	23	21	15	13	30	29	23	20	17	10	108	90	43.2	36	–7.2
II	22	14	22	10	24	16	25	15	16	15	109	70	43.6	28	–15.6
III	24	15	29	13	18	8	18	6	15	12	111	54	44.4	21.6	–22.8

the three crops respectively. The **Table 2** depicts the number of worms that are dead due to diseases etc. A similar observation showing significant loss of worms in the indoor rearing due to diseases other than pebrine was reported on different species of *A. mylitta.*[8,9]

From the earlier methods adopted for indoor rearing in polythene bags, trays and earthen pots, ERR (Effective Rate of Rearing) was found to be 40%, 10% and 30% respectively[10]. The Chawki worm rearing has reported 11.64% increase in the ERR.

Table–2 : Mortality of A. mylitta (Andhra local) of outdoor and indoor rearing.

Crop	Mortality		Pebrine		Viral		Bacterial		Pests		Rainfall		% loss due to pests		% loss due to rainfall.		% loss due to diseases	
	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor	Outdoor	Indoor
I	108	90	2	3	34	42	31	45	41	–	–	–	16.4	–	–	–	26.8	36
II	109	70	3	–	31	36	30	30	36	–	9	4	14.4	–	3.6	1.6	27.6	26.4
III	111	54	–	1	24	21	25	19	50	–	11	3	20.2	–	4.4	1.2	19.6	16.4

Compared to these methods, in the present studies, ERR (by weight) was 54.78, 68.47 and 75.89 with total indoor rearing and 54.81, 55.77 and 58.38 in the I, II and III crops respectively. In the second and third crops, the ERR in indoor rearing has increased by 12.7% and 17.42% respectively. There was an increase in ERR (by number) in total indoor rearing by 7.2%, 15.6% and 22.8% in the three crops.

The reelability of outdoor reared cocoons in the three crops were 4.66, 5.05 and 6.19, while that in indoor rearing were 2.57, 3.36 and 4.23 respectively. There was a crop-wise increase in reelability in outdoor and indoor, while outdoor reared cocoons showed significantly more (1.6–2.0) reeliability than that of indoor reared cocoons.

The characters of outdoor and indoor cocoons such as shell ratio, shell weight, shell diameter, cocoon weight, peduncle length, etc have shown clear distinction and superiority in the outdoor ones. The difference noted between the two types of rearing was rather narrow in certain aspects such as cocoon weight, shell weight and width of the shell. There was no change in the silk fibre diameter between outdoor and indoor cocoons. However, ERR and Denier of indoor cocoons are better than the outdoor cocoons.

In the present investigation, the physical parameters like length, colour and weight of larvae, cocoon and pupa, biochemical parameters like protein, lipids, glycogen, trehalose, etc and cocoon characters[11] have shown a narrow range of difference.

From the present study it is clear that *A. mylitta*, Andhra local ecorace, is not averse to total indoor rearing and has shown encouraging results with reference to ERR Denier and mortality and very little fluctuations in the biochemical aspects.

The indoor rearing of tasar silkworm can be implemented by making a few modifications like adopting a via media by rearing upto third instar under indoor conditions as explained in the present studies (methodology) following outdoor rearing in areas exclusively isolated from other ecoraces for better results.

APPLICATIONS

Non-mulberry sericulture holds great economic promise for the world forestry as a supplementary activity[12], helping arrest deforestation and permitting gainful utilization of natural wealth.

The development of non-mulberry products and their diversification would lead to enhanced

domestic and export markets. The non-mulberry sector provides gainful employment to more than 7 lakh people in tribal areas.

CONCLUSION

Being wild in nature, naturally the basic efforts required are towards its domestication in the lines of *Bombyx mori*, the mulberry silkworm. The concept of domestication of *A. mylitta*, though unimaginable a decade ago, has become an acceptable phenomenon in recent years due to some concerted efforts by sericologists.

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DO YOU KNOW ?

Q7. How many volcanoes are there on earth ?

Q8. What is anonas cosmosus ?

FIRE RESISTANT STEEL

B. K. Panigrahi

BASIC TECHNOLOGY

Fire resistant weldable quality steels have been introduced for commercial usage in the construction segment. This steel exhibits minimum two-thirds of its room temperature yield strength at 600°C as specified in IS 15103 : 2002. Thus the structure will have adequate load bearing capacity even after exposure to higher temperature due to fire. In view of this, the risk against fire hazards is substantially reduced. Application of this steel reduces the overall cost of construction and maintenance of the structure by replacing the conventional cost intensive material/coating. This steel is alloyed with small amount of chromium and molybdenum. Additionally one or more microalloying elements (Nb, V. Ti) are added, if required, for specific application. This steel is also characterised by good ductility, bendability, weldability besides having adequate impact toughness.

ALLOYING CONSIDERATIONS

Carbon—manganese mild steel structurals can be safely used only upto about 350°C, Beyond this, the drop in yield strength is faster. Addition of molybdenum and chromium increases the elevated temperature yield strength so that two-third of room temperature yield strength can be retained at 600°C (Fig. 1). Niobium, vanadium and titanium are added to obtain specified ambient temperature and elevated temperature yield strengths over a wide range of product size. It has been possible to design five varieties to fire resistant

steel for specific need by optimum combination of alloying elements (Fig. 2).

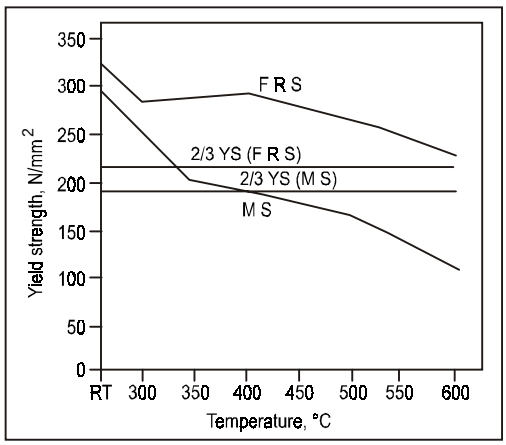

Fig. 1 : *Dependence of yield strength on temperature*

EFFECT OF MICROSTRUCTURE

Basically, a polygonal ferrite-pearlite structure of moderate grain size or a bainitic/tempered martensite structure is desired for good elevated temperature yield strength. This is achieved by control of thermo-mechanical processing schedules.

* Steel Product group, RDCIS, Ranchi

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In case of structurals and plate products, lower finish rolling temperature in the unrecrystallised austenite region is avoided due to possibility of

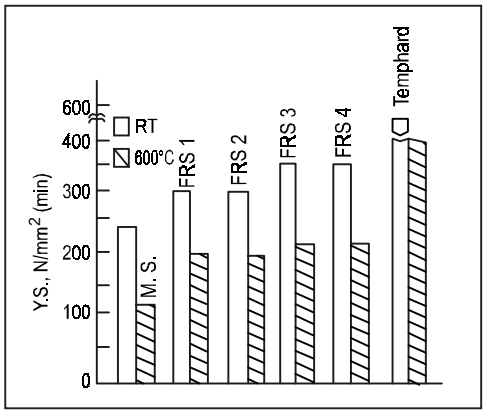

Fig. 2 : *Alloy design to obtain minimum ambient and elevated temperature strength*

dislocation strengthening, since dislocation strengthened steel is liable to loose strength rapidly at higher temperatures. Fig. 3. shows the typical microstructures of fire resistant steel.

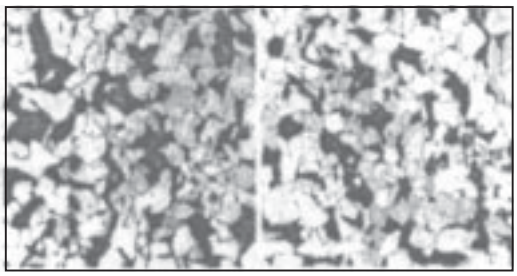

Fig. 3 : *Optical microstructures of SAIL-FRS-1 beam material at room temperature and after exposure at 600°C for 3 hrs. (Magn. 200X)*

PROCESS ROUTE FOR MANUFACTURE

The process flow chart for fire resistant steel is shown in Fig. 4. This steel can be produced in open hearth furnace (OHF), basic oxygen furnace (BOF) or electric are furnace (EAF).

The liquid steel is cast as ingot, billet or slab or as bloom. The bloom/slabs/bllets are soaked in the reheating furnace and are thermo-mechanically processed to structurals (beam, angle, channel) or plates or TMT rebar of varying sizes.

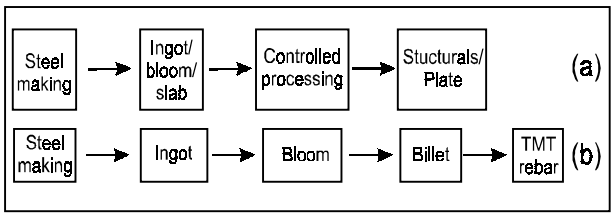

Fig. 4 : *Process chart for production of fire resistant steel, (a) structural and plate, (b) TMT rebar*

GRADES DEVELOPED BY SAIL

SAIL has developed five varieties of fire resistant steel :

- SAIL FRS 1 (minimum yield strength : 300 N/mm^2).
- SAIL FRS 2 (minimum yield strength : 300 N/mm^2)–V microalloyed
- SAIL FRS 3 (minimum yield strength : 350 N/mm^2) – Nb microalloyed.
- SAIL FRS 4 (minimum yield strength : 350 N/mm^2) – V + Nb microalloyed.
- TEMPHARD TMT Rebar (min. YS : 60 N/mm^2)

The chemical composition and mechanical properties to these steels are shown in Table I and Table II respectively.

Fire resistant steel is also characterised by excellent fire resistance properties. Full scale fire resistance test (Fig. 5) conducted at Central Building

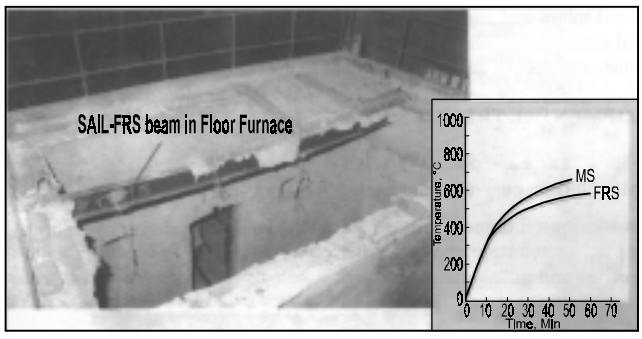

Fig. 5 : *Time temperature relationship for fire resistant steel and mild steel*

Research Institute, Roorkee showed that the time to reach critical temperature (538°C) by fire resistant

steel beam is higher than mild steel (typically about 31% more for SAIL FRS I beam). Similarly the central deflection of SAIL FRS I beam is about 14% less than mild steel after exposure to fire in a fire resistant test.

APPLICATIONS

Based on the specific application, a grade can be offered for optimum performance. This steel can be used in high rise steel frame buildings, multi-storied car park, structures in petroleum refinery, oil drilling-structure, high pressure boiler plant, apartment construction, airport terminal, satellite launch structure and construction of reinforced structure. Several varieties of this steel are in use abroad for more than a decade. This steel has vast potential in steel plants also particularly in the fabrication of gas pipes, overhead furnace, cast house structure, rocking runner, by-product plant, oxygen plant chimney, oil strorage shed, underground mines and coal storage shed. The typical application of fire resistant plate and structurals is given in Table III.

TABLE I : CHEMICAL COMPOSITIONS OF FIRE RESISTANT STEELS (WT. % MAX)

Elements	SAIL-FRS-1	SAIL-FRS-2	SAIL-FRS-3	SAIL-FRS-4	Temphard
Carbon	0.20	0.20	0.20	0.20	0.30
Manganese	1.50	1.50	1.50	1.50	1.50
Silicon	0.50	0.50	0.50	0.50	0.50
Sulphur	0.04	0.04	0.04	0.04	0.04
Phosphorous	0.04	0.40	0.04	0.04	0.04
Chromium	0.55	0.55	0.55	0.55	0.70
Molybdenum	0.45	0.45	0.4	0.45	–
Vanadium	–	0.10	–	–	–
Niobium	–	–	0.05	0.12*	–

* includes V also

TABLE II : MECHANICAL PROPERTIES OF FIRE RESISTANT STEELS (WT. % MAX)

Elements	Units	SAIL-FRS-1	SAIL-FRS-2	SAIL-FRS-3	SAIL-FRS-4	Temphard
YS. min.	N/mm^2	300	300	350	350	600
UTS. min.	N/mm^2	450	450	500	500	700
Elongation, min (GL = 5.65, A)	%	21	21	20	20	10
YS, at 600°C, min.	N/mm^2	200	200	234	234	400
Charpy Impact Toughness at 0°C, min.	Joule	27	27	27	27	–

DEVELOPMENTAL TRENDS

Fire Resistance Steel with Atmospheric Corrosion Resistance

Now-a-days bare steel frame structures are replacing paint coated structures for saving of construction and maintenance cost and also for architectural appeal. In order to prevent corrosion, special category of fire resistant steels has been developed. These steels are characterised by improved corrosion resistance and fire resistance and are ideal material for construction in industrial belt and coastal region. These steels are produced by addition of copper, nickel and phosphorous depending on the intended application.

TABLE III : APPLICATION OF FIRE RESISTANT STEEL AND INTERNATIONAL SPECIFICATIONS

Product Type	Thickness (mm)/ OD (mm)	International Code
Plate-General	6 < t < 100	NSFR 400 B, C NSFR 490 B, C
Weather resistant	6 < t < 100	NSFR 400 B, C, W NSFR 490 B, C. W
Square Pipe-U Column	6 < t < 16	STKR 400 FR STKR 490 FR
C Column	12 < t < 40	NSFR 400 B, C, W NSFR 490 B, C, W
H Shapes General	t < 40	NSFR 400 B, C NSFR 490 B, C
CT Shapes-General	t < 40	NSFR 400 B, C NSFR 490 B, C
Seamless tube	165 < OD < 406	NSFR 400 TK NSFR 490 TK
UO tube	457 < OD < 1422	NSFR 400 TK
SAW Pipe	OD > 400	NSFR 400 TK NSFR 490 TK
ERW tube	43 < OD < 406	NSFR 400 TK NSFR 490 TK
Angle	6-10	NSFR 400 B
Channel	6-12.5	NSFR 400 B

GLOSSARY

Dislocation Strengthening : A method to increase the yield strength of steel by build-up of dislocations at an obstacle, such as grain boundary, precipitate particle etc.

Critical Temperature : A temperature above which the structure is considered unsafe.

SUGGESTED READINGS

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{*Contributed by Steel Product Group, RDCIS, Ranchi*}

SHORT COMMUNICATION

HOW OLD CAN A HUMAN BEING GET ?

D. Balasubramanian*

We are on the threshold of the 21st century. There possibly are not too many of us around today who have had the privilege of seeing the 20th century ushered in, and probably even fewer who will have the double distinction of seeing both the 20th and the 21st centuries dawn. Those would be rare individuals, indeed, since, the number of 100 year-old people in India is rather small. These centurions would truly have seen the world, and the vicissitudes and the progress that the 100 years have brought about. The average Indian did not live beyond 26 when the 20th century dawned ; today he is expected to live upto 52.

What are the vicissitudes ? A child born one hundred years ago faced the danger of acute diseases. Tuberculosis, typhoid, cholera, small pox, diphtheria and acute diarrhea were the main killers—not just in India but the world over. Every second child died before the age of six in many countries. Families adapted to this given reality by producing more children. This of course was a strategy to beat the numbers game, where the hope was that at least one or two children survive and grow into adulthood. Adults faced the additional vulnerability of wars and soldierdom. One needs to only ponder over the number of unnecessary and totally avoidable deaths that occurred during the frequent skirmishes, battles and the wars. The charge of the Light Brigade, Waterloo, the Crimean war, the Boer war, the colonial conquests and World Wars I & II might have the patina of heroism, historical imperatives and other rationalizations. But they killed people. War kills people, and does so by the millions.

What has been the progress ? Killer diseases such as typhoid, cholera, pox and plague have been contained and partially eradicated. The saga of the microbe hunters starting from Edward Jenner and Louis Pasteur to the present day virologists is a heroic, stirring and positive one. Even the most primitive sanitary and hygienic practices have sufficed to ward off death. The discovery of disinfectants, germicides and antibiotics has ensured that a child need not die of these disease any more it is not every other child dies of them today, it is one child in fifty. Infant mortality today is 2% of what it was ninety years ago. Such a dramatic improvement has come about because of an understanding of the basis of diseases. And to understand is to control. It is mainly for this reason that the family planning programme has a chance of being successful. The war against smallpox is over and the virus has been banished from the face of the earth. Plague may not wreak its savage toll any longer. But sadly enough, diarrhea still kills. Gastric diseases still kill children in slums and in villages. Epidemics still haunt us in times of floods and famine.

But now we know what to do when this occurs. With some planning and determination, we can save lives. Alas, how we wish the same is true of wars and battles ! Nature has showed science the

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way and political science should learn and follow suit.

What are the killer diseases today ? Not the acute ones of yester-years such as small pox or cholera, but chronic ones such as cancer, emphysema, cardiopulmonary diseases, arterio-sclerosis, arthritis and the like. These stalk and hit adults and the elderly more than children. With this shift from the acute to the chronic, the average life expectancy has increased from 26 to 52 years in India. In the US, it has risen from 43 in the year 1900 to 73 in 1980 and a bit higher today. This has led to a curious demorgraphic shift, namely, there are more people over 50 years now than even a generation ago. Better hygiene, health practices, nutrition and diet, vaccines and antibiotics and higher literacy and awareness have meant more elderly people, senior citizens or geriatrics in the population. Most of them are hale and hearty, active and productive. And this has raised a very interesting and lively debate in America on the issue of when should one retire from his job—55, 58, 60, 65 ? Or need one retire at all ? At least twently universities in the US have abolished the mandatory retirement age. If a professor is fit enough, he continues for life and is not sent home at the age of sixty-five.

Now this is a hornet's nest, If there ever was one ! What should one do in a country like India where the population is enormous, the number of qualified people so large and the number of jobs limited ? In addition, tradition in India holds the elderly in higher esteem and seniority is equated with greater wisdom. More often than not, it is they who make the rules. What about the individual in all this ? He or she is not just a member that simply makes up the statistics, but flesh and blood, head and heart, and one who contributes to society. With the increased quality of health, he now lives longer and needs to fashion his own life plans in ways different from what his parents did. The average life expectancy means less for him than his own life span. Of greater interest to him is the question of how long will he himself live. Can he live up to 90 or 100 if he were to be careful in his health habits ? What is the limit to the human life span ? Current debate in the Gerontological Society of America is on this issue. Professor James Fries of Stanford thinks that the human body has an inbuilt limit of 85 years, while Porfessor James Vaupel of Minnesota challenges this notion and puts the limit to as high as 110 or greater. The notion of a finite life span—85, 110, or whatever—for an individual, rests on the seminal findings of Leonard Haryflick of America in 1970, who approached it from the levels of our body cells. We all grow as individuals from the original egg-cell of our mothers. This cell divides repeatedly to produce tissues, and differentiates to produce different types of tissues and organs. As we age, the cells in our bodies become less efficient in their activites, they divide less often and ultimately die. In our youth, our hearts, lungs, kidneys, liver and other organs function supremely, to a capacity which is 4-10 times that needed for sustaining life. The existence of such "organ reserve" enables us to cope well with environmental stress and function. As we age, this organ reserve decreases and even a small stress perturbs the system. An elderly person may cope with one minor stress (say a fall or an infection) only to succumb to another equally minor one. Fries uses the analogy of a sun-rotted curtain. "You patch up a tear here or sew up one there and it just tears some place else".

Hayflick showed that when human cells are asked to divide in the laboratory they do so efficiently up to a point. One cell divides to two, two to four and four to eight quite well but something happens after fifty steps of such division. After fifty doublings, cells first fail to grow and then die even though there has been no change in the nutrients or other conditions in the "culture medium", as the solution is called. This limit of the cell-doubling number appears to differ from

species to species. There are more doublings seen in long-lived animals like man or the elephant, while it is less than fifty with rats or mice that live shorter lives. Thus, the question is whether the cell has a built-in programme or a "death gene" that programmes its life span ? There has been much debate on this issue.

Vaupel argued that if ageing or senescence is determined by genes, identical twins should age and die at about the same are, provided they have not succumbed to premature death. To test this out, he turned to the Registrar's office in Denmark where they have kept a meticulous record of the births and deaths or over 4000 identical twins. When he analyzed the twin registry data, he found that the mean age of senescent death was not 85 but some number greater than 110. In addition, he has also argued that the dispute about a pre-programmed life span is not limited to humans alone, but should include other animals and insects as well. Studying the fruit-fly is particularly rewarding since they can be grown in millions and they live up to 100 days or so, a convenient time period for human scientists to study several generations of them in a few years. The data about millions of flies would also firm up the statistical analysis and overcome any one particular drawback of human studies.

In order that one gets rigorous statistical data, one needs large numbers in each group. But there are too few people over 85 years and this makes the statistical graph lopsided. The flies which are prolific in number but short-lived in age have already helped, since Vaupel, who is collaborating on this project with James Carey of California, has already recorded the death of the millionth fly in the study. The preliminary results are startling. The probability of dying increases for the first third of the life span of the flies and then levels off. That means that if a fly does not die within the first month, the chances are that it would live on and on ! This result needs to be repeated and confirmed —but it argues against a programmed life span of 100 days for the fly, and in extrapolation, 85 years for humans. Put another way, if there is a 'death gene" it does not function before 110 years in humans.

Does this mean that we will all be Jatayus, Jambavans or Methuselahs starting with the 21st century ? Far from it, the debate has just begun. It will take a while, perhaps a few years, for the dust to settle on this controversial issue and, as Marcia Baringa has aptly said, for the "furflying" to stop and definitive conclusions to be arrived at. In any event, Dr Jay Olshanky of Chicago, estimates that the major degenerative diseases such as cancer, arthritis, arteriosclerosis and the like would need to be cured before longevity reaches 110-120. At present, the only region in the world known for its supersenior citizens of 120 and even 130 years of age is the Armenian and Azerbaijan belt but before starting to marvel at this longevity, I for one would like to be assured that the dates of birth and death are authentic and substantiated.

KNOW THY INSTITUTIONS

RAJENDRA MEMORIAL RESEARCH INSTITUTE, PATNA

Rajendra Memorial Research Institute was established in the year 1963 in the memory of the first President of independent India, Deshratna Dr. Rajendra Prasad. From 1963 till 1980, the research activities was on Chest related diseases especially on Tuberculosis which was widely prevalent in the coal belt of Bihar. It was taken over by ICMR in March 1981 from Registered Society of Bihar State along with its building, staff and assets. The Institute aims to undertake research on Kala-azar and other parasitic diseases of regional importance. Built in with approx. 9 acres of land, it has got a huge building having four research blocks, adminstrative block and 54 staff quaters in the premises.

THRUST AREAS OF RESEARCH

Research priorities on Kala-azar have been identified by the institute in its gap area that are being stressed in a phased manner. Research effort is stressed in the areas of disease epidemiology, pathology, parasite characterization, leishmania parsite bank, development of diagnostics, chemotherapy, host immune responses, the vector biology and its control and social aspects. Besides kala-azar, Post Kala-azar Dermal Leishmaniasis (PKDL) is also studied for the its various aspects. This institute is functioning as surveillance and testing centre for AIDS in Bihar under the supervision of National AIDS Control Organization (NACO) in collaboration with State AIDS cell.

Areas of research facilities have been introduced this year to its existing ones such as molecular biology for development of DNA/RNA diagnositc probe and epidemiological modeling.

The important thrust areas of research are on diagnostic aspect of Kala-azar such as developing nucleic acid based prove, western blot technique, DAT and IHC staning technique for diagnosis for PKDL, parasitological aspect such as cryopreservation for establishment of leishmania bank, parasite growth kinetics, virulency and isoenzyme characterisation. Clinical trials for different combination of anti-kala-azar drug have been taken up. Epidemiological studies to assess infect in dynamics, transmission factors and epidemic predictions by help of mathematical modelling and remote sensing technique have been important areas of research. Vector biology and control studies have been given emphasis in last few years.

LABORATORY FACILITIES

1. Pathological Investigation : Pathological investigations like TC, DC, ESR, Hb%, Platelet count, TEC, Reticulocyte count, urine and stool examination of kala-azar and PKDL patients admitted in ward are being carried out. Histopathological examination of skin biopsy, imprint smear cytological examination of dermal lesion of PKDL patients and immuno-histochemical staining are being performed. This division is well equipped with modern and sophisticated equipment like Rotary Microtome, Autosharp 5-SHANDON, Binocular transmitted light microscope, Photomicrography system, Centrifuge, Balance, Hot air over and Incubator.

2. Biochemical investigation : Biochemical investigations related to Kala-azar patients, i.e. Blood Glucose, Blood Urea, Serium creatinine, Uric Acid, bilirubine, SGOT, SGPT, Total Protein, A/G Ratio, etc. are being carried out. Isoenzyme Characterization of leishmania parasite is also being done. Enzyme studies in relation to macrophage secretory function were also done. Equipment, like electrophoresis, cooling centrifuge, single pan digital electronic balance and spectrophotometer, are available in Biochemistry division and more new equipments are expected shortly.

3. Immunological Investigation : Immunological investigation currently being performed in the division of Immunology are based on the present research projects like trial of DAT, antigen characterization by Western Blot Test, sequential CMI studies. Equipment like Lyopholizer, Centrifuge machine, BOD Incubator, Mini Protein III cell, Mini Transfer Blot Electrophoresis (transfer cell), Filter Paper Transblot, Filter Pad Mini Transblot, Bio Ice Cooling System, CO_2 incubator and Laminar flow are available. Besides these, Autoclave, Hot Air Oven, Incubator, Water Bath, Centrifuge Machine, Inverted Microscope, Microscope and Micro Centrifuge Machine are also available.

4. Microbiological Investigation : Microbiological investigation currently being performed are smear examination for L.D. bodies, primary isolation of leishmania promastigotes from bone-marrow, splenic aspirates of KA and PKDL patients, culture adaptation of new isolated promastigotes, in-vitro maintenance of different isolates, mass culture of promastigotes, cryopreservation of isolates, isolation of DNA/ RNA from leishmania promastigotes, PCR and RELP of isolates, isoenzyme characterisation of leishmania parasites, detection of HIV antibodies and urine culture, sensitivity tests. The equipments available at present are ELISA reader, colling centrifuge, fluroscence microscope, inverted light mocroscope, Ultra sonic processor, laminar flow and facilities for cryopreservation. Nucleic acid sequenceing system, hybridization oven/shaker, U-V transilluminator with photography facility,

PCR, Gel electrophoresis with power pack and suthern blotting equipments are recently made available under DBT sponsored project for molecular biology work.

5. Animal House : Animal facilities are available with 500 animals comprising Rabbit, BALB/C mice and Golden Hamsters. Different isolates of Leishmania are maintained by infecting these animals for these studies. Important projects underway include breeding experiments, antisera development, Leishmania Fraction based immunization and transmission studies.

6. Insectorium : Insectorium with established closed colony of sandflies are available with standardized colony of *P. argentipes* and *P. papatasi* to address issues on vector bionomics, vector control, vector epidemiology and other areas of research in Kala-azar. Transmission dynamics (with relevance to vector), vector compatibility (vector-parasite-relationship), insecticide susceptibility, iso-enzyme studies (for strain variation), cytogenetical studies etc. are some of the studies which are at present going on with existing Insectorium facilities.

7. Audio-visual Section : The institute has one audio-visual section which provide all sorts of facilities like photography, slide preparation, drawing etc. to the scientists of this institute. Also, at the time of annual meetings, seminar, workshop, conference, it supports all technical infrastructure. This section is well equipped with modern facilities and equipment like photocamera, slide-camera, photo developing, tracer, amplifier, speakers, conference system etc.

CLINICAL FACILITIES

The institute has an indoor ward with a capacity of 35 beds and on average 150-200 patients of Kala-azar and PKDL are admitted every year from different parts of Bihar. The institute has an outdoor patients department where on average 200 patients are being examined every month by the physicians of the institute. After confirming the diagnosis, patients are admitted to the ward. For preliminary investigation of the patients attending OPD, a pathology section is also working under OPD incharge. There is a Radiology section which undertakes X-ray of the patients, both attending OPD and admitted in ward. For monitoring cardiac function of the patients, the ward has got ECG machine which is being operated by the attending physicians of the institute. The institute has facilities of all sorts of pathological, biochemical and immunological investigations which are very essential for the confirm diagnosis of Kala-azar and PKDL cases.

COMMUNICATION FACILITY

Library : The institute has its own library situated in the main building. The library has several reference books, text books, articles, journals of national and international repute, proceedings of symposium, workshop, seminars etc. related to various aspects of medical and bio-medical sciences. Apart from the scientists of the institute, the library facilities are being availed by other scientific community and medical professionals.

Computer application : The instiute has a Bio-statistics division having three qualified statistician who assist scientists of the institute in preparation of their project protocol especially in planning and designing of the study. For computational activities, two Computers PC (Pentium Processor have been installed in the division. The available software are MSDOS and WINDOW based package like MSWINDOW 95, MSWORD, MSEXCEL, FOXPRO, LOTUS, WordStar, EPIINFO, SPSS etc. One computer PC each is installed in other divisions like Social Science, Pathology, Entomology and for MEDLAR search. Four new computers have been installed this year in different divisions.

Training : Training programmes are being organized on request of State Government for

State Government Medical Officers and Para-medical staffs. WHO Fellows are also being trained on various recent techniques on Kala-azar as per WHO request. This year training proposal has been made to undertake training to State Government doctors working at peripheral health centre on areas of Kala-azar Control.

Consultancy : Consultancy is being provided to State Government in control of Kala-azar, during epidemic like situation and also on community awareness programmes.

For Details kindly contact :

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LIFE SKETCHES OF OFFICE BEARERS AND SECTIONAL PRESIDENTS INDIAN SCIENCE CONGRESS ASSOCIATION, 2007-2008

PROF. R. RAMAMURTHI
General President, ISCA

Rallapalli Ramamurthi was born on the 27th day of July, 1936 at Chennai in a traditional Hindu family. After a consistently good academic and extra-curricular record at school and college he graduated from Sri Venkateswar University College of Arts and Sciences taking both the Master of Arts and Master of Science degree and joined the faculty of the Department of Zoology in 1958.

Early in his career, his research effort came under the enviable tutelage of Prof. K. Pampapathi Rao, who not only set high standards of research but carefully tended and incubated the potential in Prof. Ramamurthi.

The mid sixties took him to Oregon in USA for post doctoral research and on return was elevated as Reader in 1972 and as Professor of Zoology in 1979. His elevation only became a temptation to commit himself to further research and teaching abroad that took him to Bonn, Tubingen, Jackson, Memphis, Urbana, Montreal, Vancouver, Columbia, Los Angeles, Washington, Nijmegen, Malta and Tokyo in the far East, covering a spread of collaborative research in as variegated fields as chemical regulatory mechanisms in endocrinology, through eco science and environmental toxicology, the collagens, bio energy systems, to diabetic and hypertensive nephropathy. His research projects were funded by numerous organizations such as the UGC, DST, DOEn, CSIR, ICMR, D.Biotech, and other agencies from abroad. He has to his credit 272 papers, 37 Ph.D's, 5 books and a host of research reports.

The academic honours he had received are galore and include among other things, Doctors of Science (Honoris casa), Fellowships of Science organizations (eg. FNA, FNASc) and membership of innumerable societies in and out of the country. These bear a silent testimony to his adroitness, application and high mental capability. He has been the architect of the UGC special assistance programme to his department, and the guiding force behind the successes of many of his junior colleagues and scores of his students who have made a name for themselves all over the world.

Despite his securing a permanent faculty position Prof. Ramamurthi never relaxed, on the other hand continued to strive hard for academic excellence. His efforts were so dedicated and calculated that he was awarded with a foreign fellowship during which time he had a golden opportunity to expose himself to the global research scenario. Prof. Ramamurthi worked with Prof. B.T. Sheer, a renowned Crustacean Physiologist in the University of Oregon, U.S.A. during 1965-68. During his tenure as a Post—Doctoral Fellow he made valuable contributions to the osmotic biology of crustaceans which has been published in reputed international

journals and widely quoted. He has established harmonious and cordial contacts with scientists of different countries which paved the way for his international visits and collaborative research-programmes. During his visits abroad as a visiting Scientist/Visiting Professor Prof. Ramamurthi worked like an ordinary research student which is the major secret behind the success in his research career and is responsible for clinching several collaborative research projects in different countries. This quality of Prof. Ramamurthi enabled him to visit various countries like U.S.A., Canada, France, Japan, Germany, the Netherlands and Britain. Prof. Ramamurthi's untiring efforts in the fields of teaching and research have been duly awarded when he was elevated to the position of Reader in the year 1972 which marked the third phase of success in his career.

As a Reader Dr. Ramamurthi continued the best research credentials he had previously established and produced several Ph.D/M.Phil Students. The voluminous work he has turned out was published in journals of National and International repute. Inspite of heavy competition, the best research and teacher credentials of Prof. Ramamurthi elevated him to the post of Professor of Zoology in the year 1979. At the Professor's level his performance has been extremely impressive both in the campus and in the country. This record of academic excellence made him to adore several positions such as Dean, Warden of the Hostels, Senate Member, and Member of the Board of Management of S.V. University. He has been selected to the governing committees in various Universities and scientific societies of the country. Prof. Ramamurthi is responsible for keeping the department of Zoology, S.V. University, Tirupati on the map of National and International research programmes by getting a large number of major projects. He operated the research projects funded by USPL-480, DCT, DBT, ICAR, ICMR, CSIR, DOEn and UGC. He also operated several projects in collaboration with research laboratories abroad. These untiring efforts of Prof. Ramamurthi enabled him to become a recipient of several National and International awards/medals such as F.N.A., F.N.A.Sc., Best Teacher Award of Govt. of Andhra Pradesh, D.Sc., (Open International University of Complimentary Medicine, Sri Lanka), Prof.K.N. Bahl Gold Medal, Fellowship of Andhra Pradesh Academy of Sciences and such other prestigious awards. These events marked the fourth phase of success in Prof. Ramamurthi's career.

A milestone in the illustrious career of Prof. Ramamurthi started with his elevation to the prestigious position of Vice-Chancellor of Sri Venkateswara University in October, 1994. The tenure of office of Prof. Ramamurthi during the first year had been peaceful and progressive as to start several new courses of vocational importance. He championed the cause of transparency of the administration which is the first of its kind in this campus. This attracted the attention of several stalwarts in administration and worked out miracles for the success of the University administration. Prof. Ramamurthi is instrumental in starting the Directorate of self-supporting courses which is championing the spread of vocationalization of education on a self-supporting basis in order to cater to the needs of changing society. In this programme as many as 20 diversified vocational courses have been started on self-supporting basis which has been well received by the student community. Prof. Ramamurthi's easy accessibility, amicable nature, humanistic approach and excellent rapport with different wings of the campus made him a popular administrator and a successful Vice-Chancellor.

PROF. AVIJIT BANERJI
General Secretary (Head Quarters)

Avijit Banerji was born on 26th May 1946 at Calcutta. He did his schooling at Calcutta Boys' School, appearing at the Cambridge Overseas School Certificate Examination 1960, standing sixth in the order of merit in West Bengal. He studied at Presidency College, Calcutta, obtaining a first class in B.Sc. (Honours) in Chemistry (1964), and then at the Science College, Calcutta University, standing first in M.Sc. in Chemistry (1966). He obtained his Ph.D. (1970) in Chemistry working with Professor (Mrs.) Asima Chatterjee, FNA, on the basis of his thesis submitted on "Nitrogen Hetorocycles". He received the Nagarjuna Prize for best piece of research work carried out in Chemistry at Calcutta University for the year 1968, and subsequently the prestigious Prem Chand Roychand Studentship and Mouat medal of the University. He has received the Basudev Banerjee Award (1985) and P.K. Bose Memorial Award (1991) of the Indian Chemical Society. In December 1993, he delivered the Professor Mukarram Hussain Khondakar Memorial Lecture at Dhaka University, which is a premier award in Science in Bangladesh.

Dr. Avijit Banerji started teaching at the Chemistry Department, Calcutta University as an Honorary Lecturer in 1971. He joined the Department as Lecturer in July 1972, becoming Reader in 1979 and Professor from January 1986. He was the Head of Department of Chemistry (1996-1998), Chairman—Undergraduate Board of Studies in Chemistry, Co-ordinator of the Department's COSIST Programme and Member of the Senate of the Calcutta University. He has been actively associated with the Special Assistance Programme, later upgraded to Centre of Advanced Studies on Natural Products founded by Professor (Mrs.) Asima Chatterjee at the Chemistry Department for over 30 years. At present Professor Banerji is the Programme Coordinator of this Centre where activities have been extended and renamed as the Centre of Advanced Studies on Natural Products including Organic Synthesis.

Professor Banerji has worked at several places in India and abroad for periods ranging from about a month to nearly two years. He worked with Professor A.R.Katritzky, FRS (University of East Anglia, U.K., (1974-1976) on a Nuffield Institute sponsored Fellowship. He was a UNESCO fellow at the Pennsylvania State University, USA (1982) with Professor R.A. Olofson, Work at both centres involved research on frontier areas at the Chemistry of Nitrogen Heterocycles. He has also worked for short periods at the CDRI, Lucknow ; and IISc, Bangalore. He has visited several research organizations and attended conferences in USA, UK, Switzerland, Germany, Thailand, South Korea, Bangladesh, China, Malayasia and Singapore.

Professor Banerji's research contributions can be divided into several categories—

(1) Natural Products Chemistry in all its aspects (isolation, structure-elucidation, transformation reactions of mechanistic and sterochemical importance, synthesis, biological activity) in the

fields of (a) idole alkaloids (his initial interest), (b) Piper constituents and related compounds and also (c) Constitutents of other genera-terrestrial and marine. The latter two categories include work on peptide alkaloids, alkamides, lignans, triterpenoids, phenanthene derivatives, kawapyrones, coumarino sesquitespenoids, coumarino lignoids, plant extractines as antibiabetic agents.

(2) 1, 3-Dipolar Cyclo addition reactions of Nitrones ion have been extensively investigated regarding mechanistic, stereochemical and synthetic aspects.

(3) Single-Electron Transfer reactions and synthetic applications.

(4) Heterocyclic Chemistry included work on azetinones, chromanones, indoles, multi-centre cyclisation reactions of amidiners.

(5) Metal reagents in Organic Reactions.

(6) Nmr investigations of several classes of Natural Products and synthetic compounds; use of NMR spectroscopy as a probe to determine electronic and steric effects.

Nineteen students have obtained their Ph.D. degrees in Chemistry with Professor Avijit Banerji, and a number are working with them for their Ph.D. degree at present. Three students have received M.Phil. in Environmental Studies at Calcutta University under him.

About 120 research papers and several reviews have been published so far, and about 160 abstracts have appeared in proceedings of National and International Conferences. He has delivered several invited and Award lectures in India and abroad.

Professor Banerji is a Life Member of the Indian Science Congress Association since the 1960s. He was elected Council member (1994-1995) and then Executive Committee member (three consecutive terms, 1995-1998) of the ISCA. He was the Sectional President of Chemistry, at the 84th Session of the Indian Science Congress at Delhi in January 1997. He served as Treasurer from 2003-2005, relinquishing this office on being elected General Secretary (Headquarters) from 2005.

Professor Banerji has also been very active in the Indian Chemical Society : he served as a Council member (1981-1987, 1994-1995), Treasurer (2002-2003), Honorary Secretary (two consecutive terms—1990-1993) and Vice-President (1996-1997 ; 2000-2001). He revived the Society's international links, and was its representative in the Federation of Asian Chemical Societies, and was Project Coordinator of National Products of FACS from (1991-1995). He was a founder-member of the Board of the Asian Network on Research in Anti-Diabetic Plants (NARAP). He is a Life member of the Indian Science News Association and the Indian Council of Chemists, serving on its Council, and as Joint Secretary.

Professor Banerji was elected a Fellow of the West Bengal Academy of Science and Technology, Chemical Sciences in 1990. He is a member of the Council of the West Bengal Department of Science and Technology (WBDST), and Chairman of the Advisory Committee of Chemical Sciences.

PROF. DR. ASHOK K. SAXENA
General Secretary (Outstation)

Prof. Dr. Ashok K. Saxena obtained his Master degree in Zoology in First Division from Meerut University in 1967. He did his Ph.D degree from the Kanpur University, Kanpur in 1973. Dr. Saxena has more than 40 years teaching experience in Post Graduate and Degree classes. He first joined as a Lecturer in the Dept. of Zoology of

D.A.V. College, Kanpur in 1967, and became Reader in 1986 and since 2005 is the Principal of that College. He has 38 years of research experiences and under his research guidance 23 students have been awarded Ph.D degrees. He has contributed more than 55 papers in a number of National and International Journals. Dr. Saxena is also a Convener of the Board of Studies in Zoology of CSTM University, Kanpur.

Dr. Saxena has been associated with a number of Professional Societies including General Secretary of Indian Society of Life Sciences. He has been associated with Indian Science Congress Association for the last 35 years and first Elected Member of Sectional Committee of the section of Zoology, Entomology and Fisheries of the Association then elected Recorder of the section of Zoology, Entomology and Fisheries for the year 1993-94 and 1994-95, Later he was elected a Council Member in 2004-05 & 2005-06 and then an elected member of Executive Committee in 2006-07. He is also Life Member of different Academies/Societies like Zootomical Society of India, B.H.U., Indian National Academy of Sciences, Allahabad, Society of Bio Sciences, Muzaffar Nagar etc.

Dr. Saxena has more than 21 publications in the form of Books, Symposia, Proceedings. He is Convener of Editorial Board of Journal 'Trends in Life Science' an International Journal ; Member of Editorial Board 'Life Science Advances' an International Journal and Referee of ICAR Krishi Bhavan, New Delhi. Dr. Saxena organized more than 20 National and International Symposia/ Conferences in different Universities of India.

Dr. Saxena has received several honours/awards in recognition of his meritorious research works. Some of which are : (i) International Award of Recognition 5000 Personalities of the World for Outstanding Services to the Research and Teaching Profession by American Biographical Institute, (ii) Zoological Society of India Gold Medal for the contribution to Life Sciences. (iii) Research Fellow of American Biographical Institute (iv) One of the Member of the Research Board of Advisors, American Biographical Institute.

PROF. COL. DR. RANAJIT SEN
Treasurer & President
Section of Medical Sciences (including Physiology)

Prof. Col. Dr. Ranajit Sen was born in Kolkata on 31st January 1952. He graduated in 1974 in Medical Science and obtained Diploma in Oral surgery from Leiden, Netherlands in 1983 ; Post Graduate Training in oral surgery in 1984 ; Fellow in Dental Surgery of the Royal College of Surgeons in Edinburgh in 1985 ; Doctor of Philosophy in 1987. He obtained Bachelor of Law in 1986 from Calcutta University. He was also trained in Acupuncture, Cryogenics, Electron Microscopy, Statistics, and AIDS. He is specialist in Head & Neck Surgery, Oncology and Forensic Science. He joined Medical College, Kolkata in 1976 as a Lecturer and then promoted to Professor of Head Neck Surgery. He taught in Chittaranjan Cancer Hospital, National Institute of Homoeopathy, Armed Forces Medical College, Metropolitan Homoeopathic Medical College, Katihar Medical College and several Medical Colleges in India as Professor & Head. He was Lecturer in the University College Hospital, Eastman Dental Institute, Italian Hospital, Saint Margarette Hospital and Whipp's Cross Hospital, London. Till 2006, he served as the Medical

Director-Cum-Principal, Uttaranchal Medical and Dental Research Institute, Dehradun. Presently, he is a visiting Professor, Post Graduate Faculty of Forensic Science, Calcutta University and Criminal Detection Training School, Govt. of India.

He was credited with the Commonwealth award and several national awards.

He published till date 12 Medical books and one Law book of international repute through international publishers, namely, Elsevier, Oxford, BI, Jaypee etc. which gained popular momentum in medical academic circle. The books are : Advanced Textbook on Oral & Maxillofacial Surgery ; Surgery for oral & Maxillofacial cysts and tumors ; Oral Surgery for Medical Students ; The Principles and Management of Cancer-a practical guide ; Textbook of Local Anesthesia ; Textbook of oral Medicine ; Fractures of Mandible ; Fractures of the Middle-Third of the Maxillofacial Skeleton ; AIDS ; Basics of Modern Medical Science—Analytical Disposition ; Forensic Odontology ; Textbook of Forensic Science-Medicine. One Law book titled 'Physically Handicaps-Law & Rehabilitation' bagged Ananth Nath Deb Gold Medal of Calcutta University in 1985. He published 369 popular articles on medical science mostly in Your Health (The Indian Medical Association Magazine) ; The Statesman ; the Ananda Bazar Patrika ; the Swastha Dipika etc. He carried out research on varied aspects of Medical Science and published 47 original research papers, mostly in International journals and presented papers in 16 international and several national congresses.

He served as one of the Members in the Editorial Board of the Journal of the Indian Medical Association. Moreover, he is the member of European Association of oral & Maxillofacial Surgeons, International Association of Oral Pathologists etc.

He is devoted to social work through his three Non-Government organizations (NGOs) and one Trust. Handicapped girls are trained with stipend for tailoring work to have self-help life. More than three hundred handicapped girls are leading self-sustaining career. Free Medical aids, hearing aids, Wheelchairs, Heart & Eye operations, handicap certificates are regularly given through organized camps. Several Social Welfare projects aided by Government of India are running. He is directly related to Rotary International, Red Cross as well as Lions Club in their social welfare projects, also.

Being a Student Member in 1966 of the Indian Science Congress Association, followed by Life Member in 1974, he is intimately connected with this noble organization in its various academic activities. He served ISCA being elected as its council Member and Executive Committee Member.

PROF. B. MANDAL
President
Section of Agriculture and Forestry Sciences

Prof. B. Mondal was born in 1957 in a remote village Akabpur in the district of Burdwan, West Bengal. He pursued his studies for M. Sc (Ag.) (securing first position) and Ph. D. degrees of the Bidhan Chandra Krishi Viswavidyalaya, West Bengal. Thereafter, he had gone to Aberdeen, UK, as a Commonwealth Postdoctoral Fellow and to Goettingen, Germany as a Visiting Scientist with INSA-DFG Fellowship for advanced research.

Presently he is working as a Professor of Soil Science in Bidhan Chandra Krishi Viswavidyalaya, Kalyani with a group of young researchers.

Professor Mandal has made a significant contribution in research in the field of Soil Science and Natural Resource Management. He is the pioneer in the country to develop soil quality and resilience assessment tool with critical carbon input values and evaluate carbon sequestration potential of different cropping systems with a view to up-keeping soil health. He has also found out the natural route for increasing micronutrient availability in otherwise deficient soils and developed ingenious methods for improving use-efficiency of costly applied micronutrient fertillizers by crop plants. He has developed a technology for amelioration of soil acidity and increasing crop productivity in a vast area of land under acid soil regions of the country using low cost locally available (basic slag) liming materials. All these work have been published in different leading professional journals of the world.

A large number of research projects have been granted to Professor Mandal by various National (14 nos.) and International (4 nos.) funding agencies for extending and strengthening research activities in some emerging fields relating to soil, water and other environmental issues. He has also trained and successfully guided a good number (~20) of young students for their post graduate (Ph. D.) research.

Professor Mandal has been honoured with several prestigious awards by a number of learned National Societies/Associations/Academies viz. Young Scientist Award by the ISCA, Young Scientist Medal by the INSA, Golden Jubilee Commemoration Young Scientist Award by the Indian Society of Soil Science (ISSS), Career Award by the UGC, Dr. B. C. Deb Memorial Award by the ISCA and 12th International Congress Commemoration Award by the ISSS. Besides, he has been elected Fellows of the National Academy of Agricultural Sciences, Indian Society of Soil Science and West Bengal Academy of Science and Technology.

Besides academics, Professor Mandal is also asociated with a number of philanthropic organizations for promoting science-based society and improving livelihood of poor farming community of the country. With his daughter Anwesha (an eighth standard student) and wife Shila (a lecturer of economics in a degree college under University of Calcutta) Professor Mandal lives and enjoys a good social life at the model town of Kalyani, West Bengal in its beautiful environment.

PROF. A. L. BHATIA
President
Section of Animal, Veterinary and Fishery Sciences

Prof. A. L. Bhatia is Professor & Formerly Head (2002-2005) of the Department of Zoology in the University of Rajasthan, Incharge, Radiation Biology Laboratory of University of Rajasthan. He has been formerly coordinator, PG Studies in Microbiology (2000-2005) and formerly Director, Institute of Informatics (2002-2005) in the same University for different periods. He is Coordinator of Rajasthan Chapter of Eco Ethics International Union, Germany (Rajasthan Chapter) and Editor-in-Chief, Asian Journal of Experimental Sciences (*a 20 years old listed/cited Journal*).

Born in Mathura, U. P. in 1950, Prof. Arvind Lal Bhatia is a Humboldt Awardee. He has

throughout first Class career as a student and has also been awarded Diploma in German language from Goethe Institute, Bonn, Germany in 1989. He figures in several International anthologies Who's Who in Science, Technologies & Engineering. He has been a visitor of several national and International laboratories and has worked in Nuclear Research Centres of Germany and Belgium. He has been conferred with several fellowship, honours and awards, nationally and internationally. He has been internationally known for his work on radiation protection and tritium (pollutant, a radioactive isotope of hydrogen released from natural and man made sources) and its impact assessment, on which he obtained his Ph. D. degree way back in 1978 from the University of Rajasthan under the able guidance of Prof. P. N. Srivastava. Having several research papers and review articles to his credit on this research and being an authority on this subject ; a CD Rom has also been released from Belgium with renowned radioecologist, Prof. Rene Kirchmann, comprising his work. He has got training in neurobiology by International Brain Research Organization (IBRO) and Central Brain Research Institute, Amsterdam, Holland under the able guidance of Profs. Heidi Swanson and Swaab.

With 37 Years teaching & research experience in the University Prof. Bhatia figures on several scientific positions viz. Chartered Member, International Hormesis Society, Massachusetts, USA ; Nominated Member, Biotechnology Advisory Board of Government of Rajasthan ; Coordinator, Indian Branch of International Union Radioecologists, UK ; Executive Member, Association of Gerontology of India ; Executive member, Indo-German Society, Jaipur ; Executive member, Indo-European Educational Society ; President, Humboldt Club-Jaipur ; Convener, Western Humboldt Kolleg, Mumbai.

Scientific Achievements/Honours received by Prof. Bhatia includes : (1) *Alexander von Humboldt* Award, (Germany ; 1989-91). (2) Young Scientist Award, *Int. Cong. Radiat. Res.* (Holland ; 1983). (3) Senior Scientist Award, *Int. Cong. Radiat. Res.* (Australia ; 2003). (4) 4th *L. H. Gray Conference*-Young Scientist Award, (Oxford, U. K. ; 1988). (5) Nominated Scientist under *Indo Belgian Exchange Programme* by Government of India. (6) "Shiksha Vibhusahan" Felicitation by Rajasthan Yuva Chhatra Sanstha (2007).

22 Students have been awarded Ph. D, under him. He has participated in more than 20 International and several National Seminars. He has more than 150 research papers to his credit, published in renowned International and National Journals. As author he has been awarded by Rajasthan Hindi Granth Academy (2001) and by Rajbhasha Aayog, Government of India (2002) Central Library of University of Rajasthan (2002 & 2003). Dr. Bhatia has written over 30 small books and many popular articles, many of them have been for general masses and adult education and literacy programmes.

DR. U. DHAR
President
Section of Anthropological and Behavioural Sciences (including Archaeology and Psychology & Educational Sciences)

Dr. Upinder Dhar joined as Director–Institute of Management and Dean—Faculty of Management, Nirma University of Science and Technology on 9th December 2006. Prior to this, he was Director of Prestige Institute of Management and Research, Indore and President, Prestige Group of Educational Institutions—constituted of three management institutes, affilated to three different

state universities, and a public school. He has also been Professor and Coordinator (Head) of General Management Group at NITIE, Bombay—National Institute established by United Nations through ILO. He has taught at postgraduate level, designed and conducted faculty and management development programs, undertaken problem-solving consultancy assignments, and guided research at doctoral level for the last 28 years. Before joining NITIE, he was at the Institute of Management Studies, Devi Ahilya University, Indore ; M. D. University, Rohtak ; Indian Institute of Public Administration, New Delhi ; SOS Children's Villages of India, New Delhi ; Shri Ram Centre for Industrial Relations & Human Resources, New Delhi ; National Labour Institute, New Delhi ; and Central JALMA Institute for Leprosy, Agra.

Dr. Dhar is Ph. D. from Agra University, and has attended a number of professional development programs. He was awarded Commonwealth Fellowship twice to present his papers at the South Asian Management Forums held at Royal Institute of Management, Bhutan and Lahore University of Management Science, Lahore respectively. He is a Behavioural Scientist. He is a life member of the Indian Science Congress Association, Indian Psychological Association, Indian Society for Training and Development, Psycho-Linguistic Association of India. Praachi Psycho-Cultural Research Association, Indian Society for Technical Education and National HRD Network. He was invited to attend the Workshops/Conferences for Deans and Directors on Quality Assurance, Accreditation and Ranking of B-Schools organized by various National and International bodies including AICTE and AMDISA at Indore, Hyderabad, Bangalore, Colombo and Lahore.

Dr. Dhar, known for institution building, has been a member of various Expert and Selection Committees either as Chairman or as a Member. He has been national coordinator for the project on "Empowerment of Women through Enterprise" for its implementation in North India (1998-2000). The project was sponsored by Canadian Consortium of Management Schools and funded by Canadian International Development Agency. He has successfully completed consultancy assignments for well known organizations like Indian Rare Earths Limited (a constituent of the Department of Atomic Energy), ONGC Corporation Limited, World Bank, Herdillia Chemicals, Pondicherry University and Aegis School of Telecommunication. In connection with various professional activities, he has visited many countries including Philippines, Maldives, Pakistan, Srilanka, Bangladesh, Bhutan, Nepal and Malaysia.

Dr. Dhar has been extensively involved in the academic and administrative activities of many national and international institutions and industrial organizations. He has presented papers at several national and International conferences/seminars/ symposia. He is the author of fifteen Monographs, twenty-five Psychological Tests and over four hundred papers including other Publications in refereed academic and professional journals. Eighteen scholars have been awarded Ph. D. degree under his supervision by various Universities, and ten are currently working under his guidance for the Doctoral Degree in Management. Dr. Dhar is on the Editorial Board of Praachi Journal of Psycho-Cultural Dimensions and International Journal of Management Sciences. Dr. Dhar was Editor of Prestige Journal of Management and Research as well as Prestige Research Abstracts for one decade. He was nominated as a member on the State Level Counselling Committee constituted by the Government of Madhya Pradesh for admission in M. B. A. program in all university teaching departments and other approved institutions of the State during 1999-00, 2000-01 and 2005-06 academic years respectively. He has also been on the panel of subject experts of National Board of Accreditation of the All India Council of Technical Education, Indian Council of Social Science Research, and South Asian Quality System.

Dr. Dhar was conferred "Great Achiever of India Award" by the Front for National Progress, New Delhi in 2000. The citation inscribed on the memento reads "presented to Dr. Upinder Dhar for meritorious accomplishments in diverse fields of activities that immensely contributed for the nation's progress." As a recognition of his work, he was conferred National Fellowship by the ISTD in 2002-03. He has been cited in Indo-American Who's Who (2002), Trainers and Training Institutions Directory of ISTD in 1996 and 2002, and Indo-Asean Who's Who (2003). He has thrice been Treasurer of the Association of Indian Management Schools (AIMS) and Founder Chairman of its Madhya Pradesh Chapter. He has also been Founder Chairman of the Indore Chapter of the Indian Society for Training and Development. Besides being on the National Council of the Indian Society for Training and Development (ISTD) several times. Vice-President (Western Region) of the ISTD, President—Indore Chapters of Indian Society of Technical Education and National HRD Network, currently, he is a Member of CAAT (Committee of AIMS Admission Test).

PROF. N. K. KAUSHIK
President
Section of Chemical Sciences

Professor N. K. Kaushik is currently Professor of Inorganic and Analytical Chemistry in the Department of Chemistry, University of Delhi. He has served as Head of the Department from 2004-2007. After having done his Masters from University of Roorkee (1966) and Ph. D. from Department of Chemistry, University of Delhi (1970), he joined Rajdhani College (Delhi University) as Lecturer in 1969 and then shifted to the Department of Chemistry, Delhi University in 1972 and became Reader in 1981 & subsequently promoted to Professor in the Department in 1991. As a guest teacher he taught Analytical techniques in the Department of Agrochemical & Pest Management, University of Delhi. His major research interests are Microanalytical techniques in inorganic analysis, Synthetic and Structural Chemistry, Coordination behaviour of organometallics with biologically active ligands, Thermoanalytical behavior of organometallic complexes and calculation of kinetic parameters under non-isothermal conditions, Chemical and Biological studies with metal Nano-particles. Several 7–coordinated compounds of Ti(IV), Zr (IV) and Hf(IV) (dithiocarbamates, Xanthates etc) have been synthesized and characterized and number of such compounds has been reported for the first time.

He has been invited to deliver Lectures in Thermoanalytical Methods by Academic Staff Colleges of various Universities. Prof. Kaushik has supervised the research work of more than 30 Ph. D. and 21 M. Phil. students and he is currently advising an additional 6 Ph. D. students. He has published over 200 papers in various international and national journals and conference proceedings. He has delivered many Invited Talks at various conferences and institutes. He attended the 7th and 8th ICTAC Conferences in Canada (1982) and Czeckoslovakia (1985), respectively. He is the Life member of the Indian Science Congress Association, National Academy of Sciences, India ; Member of the International Confederation of Thermal Analysis and Calorimetry (ICTAC), Indian Thermal Analysis Society, BARC, India for several years. Professor Kaushik has made a number of contributions to the professional community. He is the Member of the Committee appointed by the Ministry of Health and Family Welfare (GOI) for setting of Tobacco Testing

Laboratories. He had been Chairman, Board of Research Studies, University of Delhi ; Member of the Committee appointed by UGC for assessing the Research Work carried out by the Department of Chemistry, Gawahati University under SAP ; Member of the Board of Research Studies in Chemsitry/Applied Chemistry for various universities like University of Rajasthan, Jaipur, S. J. M. University, Kanpur etc. ; Member of various Selection Committees in NPL, (New Delhi), Union Public Service Commission and Allahabad Public Service Commission and also Expert on Professor/Reader/Lecturers selection committees of various Universities, NCERT, Delhi College of Engineering & NSIT ; Had been expert on Scientist Selection Committee of Indian Institute of Petroleum, Dehradun, Coal Research Institute, Dhanbad, National Writing Team of the NCERT for writing Class XI and XII Chemistry text books in Hindi medium, Provost of the Dr. D. S. Kothari Hostel of Delhi University for the last more than five years.

He has been the chairman of various International and national conferences. Professor Kaushik has active interest in the teaching of science in the Hindi medium, and is actively engaged in various administrative activities of the department and the university.

DR. V. P. DIMRI
President
Section of Earth System Sciences

Dr. V. P. Dimri, took over as Director, National Geophysical Research Institute (CSIR Laboratory), Hyderabad in October 2001. He completed his post graduation and Ph. D. from the Indian School of Mines, Dhanbad, India. He was endowed with prestigious PDF in Norway for 1986-1988 and was awarded Senior DAAD Fellowship in 1996 at University of Kiel, Germany. Dr Dimri was Visiting Fellow of Norwegian Research Council, Oslo in 1999. Earlier, in 1977, he obtained advanced training for one and a half years at Geological Survey of Germany, Hannover. He is also presently Adjunct Professor of the University of Hyderabad and Honorary Professor of Andhra University, Visakhapatnam.

For over thirty-five years, Dr. Dimri has devoted himself to shaping and implementing research in basic and applied geophysics to a wide range of social and economic issues. He has steered individual as well as scientific activities of the Institute to meet the societal and national needs. To be at par with international research, he designed major scientific programmes in sectors of 'Energy Security', 'Water Security', 'Risk Assessment' and 'Frontier research areas of international repute'. Dr Dimri initiated and encouraged oil exploration below unexplored volcanic lava in Sourashtra region using integrated geophysical surveys. He is pioneering a pilot project to enhance oil recovery from Indian oil wells in collaboration with Norwegian scientists. Dr Dimri has launched a very successful project in Nalgonda district of A. P. for assessment, management and exploration of groundwater in hard rock terrains for fluoride free water supply. He has launched several projects on seismicity monitoring and he proposed a new method for Tsunami wave propagation modeling using fractals and finite elements.

In recognition of his outstanding contributions to the Non-linear Geophysics, the American Geophysical Union invited Dr Dimri to deliver prestigious Lorenz Award Lecture at its Fall Meeting during December 2007 in San Francisco,

USA. To his credit, Dr Dimri has about 100 international and national publications, 3 filed patents and 3 published books entitled 1) Deconvolution and Inverse Theory (Elsevier, Amsterdam, 1992) and (2) Application of Fractals in Earth Science (Balkema, U. S. A. 2000) (3) Fractal Behaviour of the earth system (Springer, Germany, 2005). Currently he is writing his fourth book entitled "Fractal models in exploration seismology" to be published by Elsevier science publishers in 2006. His first book was declared as a 'Didactical Masterpiece' and reference book in the field of inversion by Prof. M. Koch of USA.

Recipient of the prestigious National Mineral Award (1992-93) and DOD Award (2004), Govt of India, Dr Dimri's contributions have been recognized through the Fellowship of prestigious National Academies such as Indian National Science Academy, National Academy of Sciences and AP Akademi of Sciences. He is holding the prestigious Chair position of the National Committee of International Union of Geodesy and Geophysics & International Geographic Union (IUGG-IGU) and Research Advisory Committee of the Indian Institute of Geomagnetism (IIG), Mumbai, India. He is also the President of Indian Geophysical Union. Dr Dimri is also serving as member of various National Scientific Committees.

PROF. G. SINGH
President
Section of Engineering Sciences

Prof. Gurdip Singh (Born 1945) did his B. E. degree from Thapar institute of Engineering and Technology Patiala in 1967 in first Class with Honors division. He did his M. Tech in production and industrial Engineers from Indian Institute of Technology 1975 in first class with distinction and Ph. D. from Punjabi University, Patiala. He started his teaching in Engineering classes from University of Jodhpur in 1967 and Thaper Institute of Engineering and Technology, Patiala (TIET Patiala) 1968. He joined Deptt of Management Punjabi University, Patiala in 1982 as reader and promoted to the rank of Professor in 1992, and carried out teaching / research work in Production engineering and operation management.

He served in the Tech study Dept of Govt of Libya, Tripoli during 1988 to 1990 as Sr. Engineer attached to Ministry of Electricity. He carried out II projects on various technical aspects during this period. In the Punjabi University, Patiala along with research and teaching he served for faculty of Management as Dean of the faculty from 1994 to 1996 and head of the department from 1996-1999. In 1999 he was assigned a prestigious project to establish an engineering cum management institute at Malout named as MIMIT Malout. He served as founder Principal of this college from 1999 to 2004 and during this period he was principal of another engineering college GZSCET Bhatinda. In 2004 he joined back the Punjabi University, Patiala and established Yadawinder College of Engineering at Talwinder Saboo for the under privileged segment of society in the capacity of its founder Director. He joined as Principal at GGSCMT Kharar where B. Tech ; MBA and MCA classes are in Operation. He has successfully guided research work leading to Ph. D. for 7 students and number of projects at MBA and M. Tech level.

PROF. V. K. VERMA
President
Section of Environmental Sciences

Professor V. K. Verma, an eminent edu-scientist secured a brilliant academic profile from the University of Lucknow and was later awarded doctoral degree by University of Jodhpur. Soon after his M. Sc. in 1956 he moved to the rugged terrains of geology as an Assistant Geologist (re-designated later as Scientific Officer SB) in the Atomic Minerals Division, Department of Atomic Energy, Government of India. He entered the teaching profession in 1963 as a Lecturer in the University of Jodhpur. Subsequently he moved as Reader in 1966 to assist the University of Delhi in establishing the newly created Department of Geology. Later in 1976 he was elevated as Professor of Geology. He steered the activities as Head of the Department from 1973-79 and during 1993-94. He also served twice as Dean to lead the Faculty of Science, retiring in 1999. Even after superannuation, he was invited to assist as a Consultant in the Centre for Interdisciplinary Studies on Mountain and Hill Environment of Delhi University. Currently he is Honorary Part-time Director (Environment) of the Vogue Construction and Consultancy Sevices, New Delhi.

Professor Verma has made significant contributions in the field of environment primarily as a spin off of applied geomorphology which includes (i) quantifying terrain attributes for evaluating landscape aesthetism (ii) refinement of visual technique for digitizing landsat scenes and introduction of methods for correlating composite spectral reflectance (CSPR) with morphometric attributes (iii) probing the causative factors for landslide occurences (iv) deciphering the role of geoscientists in identifying suitable sites for wind and wave energy concentration headlands for power development and (v) tapping frictional energy from active lineament in seismic prone areas.

In the field of geology, he embarked in late 1950's quantification of sediment attributes focused perceptive insight on Central India Gondwana Geology through (i) the discovery of Voidal Concretions in the Pachmarhi sandstone (of late Triassic times) a much older sequence than reported before (ii) diagenetically generated flexibility in itacolumites and (iii) offered clues to reveal that Green sands of Lameta sequence at Jabalpur are infra and not inter-trappean piedmont terrestrial deposit.

Professor Verma initiated river and basin morphometry studies in India. His designing platform cliff-ratio and dissection percentage for marine terraces correlation and visual method for stream tortuousity have significant applications in applied geomorphology. He demonstrated the youthfulness of Satpura terrain. He has been recognized Research Supervisor for guiding doctoral work in several institutions of India and abroad (Russia and Nepal). He has contributed about 120 research publications, authored two original text books and edited 8 monograhs/compilations. He successfully supervised 19 Ph.D.'S and 12 M. Phils. Professor Verma is a Fellow of the National Academy of Sciences, India since 1975.

Professor Verma has visited and lectured in several universities and institutes of India and abroad : USA, Russia, France and Nepal. He served as President Indian Institute of Geomorphologist (1999-2000) and Indian Association of Sedimentologists (1986-90) of which he was one of the founders. He was the founder Secretary General of the Indian Geological Congress.

Professor Verma's association with Indian Science Congress dates back from student days. He acted as Convener, Forum of Environmental Sciences 1997-98 and 1998-99 where he strived hard for raising the Forum as full-fledged section. He worked as sectional committee elected member (1977-78) and Recorder (1978-80) of the Geology and Geography section ; Local Sectional Secretary Geology and Geography section (1974-75) and Local Secretary 84th ISCA session (1996-97). He was nominated as external member Endowment Committee (2001-02) and as member of Publication Committee (2005-06). Professor Verma also served the ISCA Executive Committee (2002-03) and Council (2005-06 and 2006-07) and as Chairperson for a Plenary session on 'Innovative Water Technology for poor' during 92nd session held in Ahmedabad in 2005. Professor Verma has the rare distinction of being the President of two ISCA sections : prior to Environmental Sciences he was President of Geology and Geography (Earth Sciences section 1984-85). Professor Verma delivered Platinum Jubilee Lecture in 1996 and the XIIIth Professor K P Rode Memorial Lecture in 2006, both in the Earth System Sciences of the ISCA.

PROF. A. K. NAYAK
President
Section of Information and Communication Sciences & Technology (including Computer Sciences)

Prof. (Dr.) Akshaya Kumar Nayak, Director, School of Computer Sciences, Indian Institute of Business Management obtained his Post Graduate level education in Mathematics (Operations Research) and Computer Sciences as well as Ph. D in the area of Computer Science & Application.

Prof. Nayak had been the Administrator of Centre for Instructional Material Development (funded and sponsored by MCIT, Govt of India). Regional Moderator, National Computing Centre (NCC) Manchester (U. K.), Expert, Observer & convener of DOEACC (DOE-AICTE, Govt of India Scheme), Advisor & consultant, to many organisations, member of Board of Studies, Research committee & Governing Council of many Universities & Institutes and External evaluator and / or visiting Faculty of more than 35 Universities & Institutes of national & International repute. He has participated in designing and implementation of Computer related Course curriculum for various Universities & Institutes. He has Authored and / or edited 21 books as well as Authored 78 Articles & Technical Papers, Edited 3 News letters & proceeding of 7 National Conferences & Seminars. He has conducted more than 40 Executive Development Programmes for the Professionals of private & public sector and participated in 38 National & International Conferences and Seminars. Prof. Nayak has also held the following positions : National Chairman, Data Security, 3 times member of Nomination Committee of Computer Society of India, Hony Secretary Cum Treasurer, Indian Society for Technical Education, Bihar & Jharkhand section, Recorder, Indian Science Congress Association, Indian representative to Interntional Federation of Information processing (IFIP), Austria, Hony Deputy Governor, American Biographical Research Institute, Chairman & Secretary of Computer Society of India, Indian Society for Technical Education, Indian Society for Training &

Development, Patna Chapter, Director General National Association of Computer Educations & Trainers, New Delhi.

Prof. Nayak is Fellow of United Writers Association, Chennai, Management Studies & Promotion Institute, New Delhi & National Association of Computer Educators & Trainers, New Delhi. He is at present life member of 21 Professional & Technical Societies which includes prominent Societies like Indian Science Congress Association, Computer Society of India, Indian Society for Technical Education, Indian Society for Training & Development. Institute of Electronics & Tele Communication Engineers. Indian Institute of Public Administration, Operations Research Society of India, American Biographical Institute, Indian Society for Agricultural statistics, etc. He has worked as expert member of CEDTI, Govt. of India, Reviewer of DST Project, Govt of India, Member of Board of Director, DNS Institute of Cooperative Management, Ministry of Cooperative, Govt of India, Expert member of Bihar Public Service Commission, Banking Service Recruitment Board, Bihar, State Technical Education Board, Bihar State Secondary Education Board and many other Govt. Board & Corporations.

Prof. Nayak has received & nominated for many National, International & State level Awards, which includes Vikash Ratna Award, International Man of the year Award, IT publication Award, ISTE & CSI Awards, Best Training Award, National Science day Award, Best Teacher Awards, etc. His Biography is found in many national & International directories like Reference India, Indo-American Who's Who, World's Who's Who, Indo-European Who's Who, Asia/pacific Who's Who, Asias Who's Who of Men & Women of Achievement, Asian / American Who's Who and many other directories of professional societies.

PROF. S. N. SAHU
President
Section of Materials Science

Prof. S. N. Sahu was born on July 15, 1951 in Berhampur, Orissa. Completed schooling, graduation and post graduation in 1967, 1971 and 1973 respectively from Orissa. For a brief period, he was a school teacher in Kendriya Vidyalaya Sangathan. Completed Ph. D (Physics) in 1984 from Banaras Hindu University in the area of solar cells under the supervision of Prof. S. Chandra. From 1985 to 1991 he was a post doc / visiting scientist to Sweden, Australia, Brazil, Spain and Italy. Joined Institute of Physics (IOP) as a senior lecturer in 1991 and involved in teaching and research. Currently, he is a professor of physics at Institute of Physics, Bhubaneswar. Prof. Sahu has developed various semiconductors *viz*. CdS, $MoSe_2$, WSe_2, $CulnSe_2$, FeS, CdHgTe, CdZnSe, InP, and InSe for solar cells using low cost chemical / electrochemical and vacuum techniques. Developed a new laser deflection technique for *in-situ* stress measurement in thin films. Prof. Sahu's current research interest include nanostructure semiconductors, nanoelectronic, devices, cluster generated solids, and Nano-Bio systems for technology and applications. Different nanostructure semiconductors developed are CdS, CdSe, PbS, GaAs, HgS, porous Si and HgTe. Some of the nanostructure semiconductors emit visible light under UV excitation at ambient and acts as UV sensor materials. Nanoelectronic devices have been

fabricated using CdS, CdSe and GaAs. A new cluster deposition facility has been developed at IOP for the first time in India through a Indo-French collaboration. Fabricated new nanobiosystems in the form of nanowires & nanostars using HgTe-DNA, CdSe-DNA and CdS-DNA for biomolecular recognition applications and established the sequency dependant structure formation.

Prof. Sahu has two patents and two International conference edited books to his credit. He coauthored a book on "Handbook of semiconductor electrodeposition" by Marcel Dekker, N. Y, 1996. He has published about 90 research articles in referred journals and edited books. Delivered about 200 invited talks within India and abroad. Awarded Ph.D to 4 students on nanostructure semiconductors/clusters and nano-biosystems. In recognition of his work, he has received Rajiv Gandhi Akshya Urja award, 1995 from DST, Govt. of Orissa, Samanta Chandra Sekhar award, 1999 from Orissa Bigyan Academy, DST, Govt. of Orissa and WELCH award from IUVSTA, USA in 1986. Prof. Sahu had been in the Indian delegation to Germany and USA for nanomaterial program initiated by DST, Govt. of India. He has been in the DAE delegation to France in the nanoinitiative program by DAE. Prof. Sahu has been in various national committees of nanomaterial program, of DST and DAE, Govt. of India and also have evaluated several projects of DST, BRNS, CSIR, Kerala state DST and Israel Science Foundation. During his IOP career he has visited France, Japan and Germany several times in different capacities, Prof. S. N. Sahu has organized around 9 National and international conferences in India and recently an Indo-US workshop on "Nano-Bio interface" is to be organized in February 19-22, 2008.

PROF. DR. M. R. ADHIKARI
President
Section of Mathematical Sciences (including Statistics)

Dr. Mahima Ranjan Adhikari, Professor of the Department of Pure Mathematics, University of Calcutta and Secretary of Calcutta Mathematical Society, born on Second January, 1944 at the Village Khanjapur in the District of Midnapore (now West Medinipur) in a cultured educated family, stood First Class First in the M. Sc. Examination of Calcutta University in Pure Mathematics in 1966 with a Gold Medal and received his Ph. D. Degree from the same University. For the last 40 years he has been actively engaged in teaching and research at several distinguished institutions in India. He also worked as Professor, Dept. of Mathematics, Burdwan University, West Bengal. Assistant Professor of Mathematics, Presidency College, Kolkata, Hooghly Mohsin College, Chinsurah & Barasat Govt College, Barasat.

Professor Adhikari has published 4 text books, namely, A Text Book of Topology, Asian Books Private Limited, New Delhi, 2002, Groups, Rings and Modules with Applications, A Text Book of Linear Algebra, An Introduction to Linear Algebra with Applications to Basic Cryptography, and more than 60 research papers in Indian and foreign Journals.

The research work of Professor Adhikari on algebra, algebraic topology, algebraic geometry, category theory, Lie groups, Sensor Network and

History of Mathematics has added some new materials to the corresponding literature and contributed to the existing knowledge on the related topics. More than 50 papers have been reviewed by American Mathematical Society and at least 20 of them have been referred in four foreign books of International Standard.

Professor Adhikari is a Life Member of ISCA. He is member of American Mathematical Society. He is a member on boards of editors of several Indian and foreign research journals. He is the President of Institute of Mathematics, Biotechnology, IT & Computer Science (IMBIC) with branches in Sweden and in Japan and Vice-President of the Institute of Polymath, Nagoya, Japan. He has been a member of many Expert Committee in India and abroad. His contribution for promotion of Mathematics Education and Research in India is enormous and praiseworthy. His endeavour to encourage the students from the school level for higher studies in mathematics is remarkable for the improvement of Mathematical scenario in India.

Professor Adhikari guided eleven research scholars towards their Ph. D (Sc.) degrees and is still active in guiding eight more Ph. D. students at the University of Calcutta. He visited and delivered lectures in 17 different foreign Universities/ Institutes during the last five years, namely, University of Dhaka, Bangladesh in 2002, University of Ulster, UK in 2002, Technical University of Istambul, Turkey in 2002, Bolo University, Turkey in 2002, Aristotle University, Greece in 2002, University of Athens, Greece in 2002, University of Roma 2, Rome, Italy in 2003, E.T.H., Zurich, Switzerland in 2003, Chuo University, Tokyo, Japan in 2004, Tohoku University Japan in 2004, Mejo University, Japan in 2004, Tokyo Institute of Technology, Japan in 2004, Chiba Institute of Technology, Japan in 2004, Linkoping University, Sweden in 2005, Karlstad University, Sweden in 2005, Ecole Surprieure d'Elctriciti (suplec), France in 2005, University of Rajshahi, Bangladesh in 2007.

Professor Adhikari has been very active internationally. He has collaborative research work with some world famous mathematicians, namely, H. J. Weinert (Germany), Klingenberg (Germany), Gr Tsagas (Greece), J. S. Golan (Israel), Y. Shikata (Japan) and Erik Trell (Sweden) and many others and also made academic interaction with Professor R. Henstock at University of Ulster, UK in 2002, Professor S. S. Abhyankar in Kolkata in 2002 and 2006, Professor B. Eckmann at E. T. H., Zurich, Switzerland in 2003, and Professor P. J. Hiton at E.T.H., Zurich, Switzerland in 2003.

Professor Adhikari has an ongoing Research Project jointly with Dr. Avishek Adhikari, Dr. Rajat Bandyopadhya at Calcutta University on DNA-Cryptography funded by the Ministry of Communication & IT, Govt of India.

DR. P. R. SUDHAKARAN
President
Section of New Biology
(including Biochemistry, Biophysics & Molecular Biology and Biotechnology)

Dr. P. R. Sudhakaran is the Professor and Head of the Department of Biochemistry of the University of Kerala, Trivandrum. After obtaining Ph. D. from the University of Kerala, he undertook postdoctoral research in various premier institutions in India and abroad including University of Munster,

Germany, National Institute for Medical Research, London and University of Gottingen, Germany. His major area of research has been matrix biology, particularly cell—matrix interaction and signaling and its implications in fibrotic vascular diseases. He has over thirty years of postgraduate teaching and research experience, published over 100 papers in various International Journals with high citation index and guided over 35 students for their research degrees. He has been getting financial support for the research from various National and International agencies including DST, Govt. of India, UGC, ICMR, CSIR, US, India Fund and International Atomic Energy Agency, Vienna.

Dr. Sudhakaran has contributed significantly to academic innovation and curriculum development particularly restructuring of postgraduate education and doctoral research and vocationalisation of first degree programme by serving as member of various academic bodies and expert committees of different organizations including UGC and various Universities. He has also associated with quality assurance process, committees for evaluation of Institutions and Universities. He is also serving as a member of the scientific advisory committees of various research institutions and the Research Council of the Kerala State Council for Science Technology and Environment and as referee of various national and international journals.

Dr. Sudhakaran is the current president of the Kerala Academy of Sciences and is the president elect of the Indian Society for Atherosclerosis Research. He has been the recipient of a number of fellowships, honours and awards, including J. C. Bose Award for Research in Life Sciences—Hari OM Ashram Trust Award, Elected Fellow, Kerala Academy of Sciences, Career Award in Science, Commonwealth Academic Staff fellowship and German Academic Exchange Service Fellowship.

PROF. L. JHA
President
Section of Physcial Sciences

Professor Lalan Jha was born in Dherukh, Darbhanga, Bihar in 1942. He received his B. Sc. Physics Hons. Degree and M. Sc. Physics Degree with 1st Class with Electronics and Radio Physics as a special paper from Bihar University, Muzaffarpur in 1962 and 1965, respectively. He received his Ph. D. Degree from Mithila University, Darbhanga in 1977 on Dielectric Antenna. He carried out his doctoral work in active collaboration with Microwave Antenna laboratory, Institute of technology, B. H. U., Varanasi. He was employed as lecturer in physics in 1965 in Bihar University, Muzaffarpur and was posted at C. M. College, Darbhanga. He was promoted to the post of Reader from 1980 and that of Professor from 1985, at the University Department of Physics, L. N. Mithila University, Darbhanga. He was made Head of the University Deptt. of Physics and Dean of the Faculty of Science, L. N. Mithila University Darbhanga in 1999. His research field has been Antenna and Propagation. More than 25 scholars received Ph. D Degree under his supervision and guidance. He has been credited with more than 80 research papers published in Scientific Journals of National and International journals of repute and National and International Conference Proceedings.

Prof. Jha is Life Member of Indian Science Congress Association and Member of IEEE, USA. He presided at several sessions of National and

International research conferences. He retired from his service on 31st July 2002. After retirement from service his research project "Microstrip Patch Antennas" has been approved under Emeritus Scientist Scheme by CSIR, New Delhi. Now he has been working on his research project as Emeritus Scientist. He has been elected as Recorder of Physics Section of Indian Science Congress Association (2004-2006). At present he is the Director of Women's Institute of Technology, L. N. Mithila University Darbhanga.

PROF. S. V. S. CHAUHAN
President
Section of Plant Sciences

Professor S. V. S. Chauhan was born on 15th July 1943 at Vrindavan (Mathura). He had all his education at Agra, initially from Govt. High School and later at B. R. College (now RBS College), Agra. Passed M. Sc. in 1963 and was appointed as lecturer in the Department of Botany, B. R. College, Agra in July, 1963 where later he has served as Reader & Head of Department before joining Dr. B. R. Ambedkar University (formerly Agra University), Agra as Professor & Head, Department of Botany, School of Life Sciences in January 1998. He was the founder Dean, Faculty of Life Sciences for three years. (1998-2000). He was awarded Ph. D. degree in 1973 and D. Sc. degree in 1988. The research work is mainly focused on Reproductive biology with particular reference to male sterility in plants which is well exemplified by more than 350 research papers published in National and International Journals of repute. His research work is based on the morphological, histochemical and biochemical studies in several genic, cytoplasmic, induced (both by chemicals and gamma-ray irradiation) and environmentally induced (temperature, RH, virus, aphids, nematodes and fungi) male sterile plants. A series of papers were published showing involvement of various tapetal abnormalities in pollen abortion. Pollen abortion was also found to be associated with the deficiency of DNA, histones, total proteins, free proline total carbohydrates and difference in the profile of some isozymes of acid phosphates, esterases, and peroxidases. Development of endothecium in relation to tapetal behaviour in several male sterile lines demonstrated dual role of tapetum. In 1982, US National Science Foundation invited him to deliver a lecture during an International conference held at St. Louis (USA).

In 1983, Professor Chauhan was awarded a fellowship by Japan Society of Promotion of Science to work at Hokkaido University, Sapporo, Japan for 10 months where he carried out Ultrastructural and biochemical studies on male sterility of various origins in *Beta vulgaris*. These studies have shown degeneration of mitochondria and association of mt DNA with cytopalsmic male sterility. Male sterility has also been successfully induced in several crops using some new chemical hybridizing agents including the detergent-surf excel. The male sterility induced by these chemicals was also found to be associated with mitochondrial abortion. The molecular studies also undertaken and these have indicated the suppression of *Bcp 1* and *callase* genes in induced male sterile plants. Ultrastructural, cytomorphological and biochemical studies in several seedless and seedbearing Bignoniaceae were made to show marked differences in the stigmatic structure.

Professor Chauhan is recipient of several honours and awards. In 1985 UGC awarded him National

Associateship. Professor Chauhan is recipient of five gold medals, Prof. Bhuvneshwar Prasad Memorial Medal, by Medalian Society of India in 1999 ; Gold medal by the Society of Biosciences in 2000 ; Birbal Sahni Centenary Medal by Birbal Savitri Sahni Foundation in 2001 ; Senior Scientist Gold Medal by International Society for Conservation of Natural Resources in 2005 and Birbal Sahni Medal by Indian Botanical Society in 2005 for his outstanding contribution in the field of Plant Reproductive Biology.

Professor Chauhan has visited several countries apart from his visits to USA and Japan. Professor Chauhan has worked for one month in the Academy of Environmental Sciences, Korea in 1985 ; at University of Debrecen, Hungary in 2004 and recently visited China and presented a paper at 12th International Congress on Rapeseed held at Wuhan.

Professor Chauhan is a life member of more than three dozens of societies and a fellow of 12 Scientific Societies (Indian Botanical Society ; Indian Society of Genetics and Plant Breeding ; Indian Phytopathological Society ; Indian Society of Ethno botany ; National Institute of Ecology ; Society of Biosciences ; International Society of Conservation for Natural Resources ; Bioved Research Society ; Indian Association for Angiosperm Taxonomy and The National Academy of Sciences, India). He has published more than 350 research papers in Indian and International journals ; Supervised 61 Ph. D. and 106 M. Phil. Students ; completed 18 research projects of UGC ; CSIR ; DST ; HLRF, Ministry of Environment & Forests and INSA.

Professor Chauhan has been associated with several scientific societies as executive councillor ; member of advisory and editorial boards of several National and International Journals (International Journal of Horticultural Sciences), Secretary, Indian Botanical Society (1998-2004), President, International Society for Conservation of Natural Resources (2006), Additional Secretary, International Society of Plant Morphologists (2005-2008) ; Editor, Plant Cell & Incompatibility Newsletter ; Founder Secretary of Society of Plant Reproductive Biologists ; Member of the Central Working Committee of Electron Microscope facility at AIIMS, New Delhi ; Expert, Screening Committee of Women Scientist Research Projects, DST (2006-2007) ; Chairman, Technical Committee, National Jalma Institute for Leprosy and other Mycobacterial Diseases for five years.

Scientific Programme of the 95th Session of Indian Science Congress

Jan 3-7, 2008 at Andhra University, Visakhapatnam

Date	09-10.45	10.45-11.00	11.00-13.00	13.00-14.00	14.00-14.45	14.50-15.35	15.35-15.45	15.45-16.30	16.35-17.20	17.25-18.05	18.10-18.55	19.00-20.00	20.00-21.00
3/1/08	Inauguration by Hon'ble PM followed by Press Meet		Bharat-Expo-2008	Lunch	PL I	PL II	Tea	PL III	PL IV	PL V	PL VI	CF	Dinner
4/1/08	PS PD	Tea	PS PS	Lunch	SCM SPL		Tea	PJL	SP SP	**PL VII** SCE (17-30)	**PL VIII**	CF	Dinner
5/1/08	**Hon'ble President of India** **FIRST NATIONAL VIRTUAL CONGRESS ON "MAHILA KISAN", (MSSRF)**			Lunch	**Bharat Expo-2008** **Children Science Congress** SPS SP Posters		Tea	SP SP Posters	**NL-YS** SP	**PL IX** SP	**PL X** SP	PL XI	Dinner
6/1/08	PD PD	PD PS	Tea PD PD	Lunch	SPS SP Posters **Children Science Congress**		Tea	SP SP Posters	SP			**CF**	Dinner
7/1/08	PS PS	PS PS	Tea PS PD	Lunch	SPS **Children Science Congress**		Tea	**TASK FORCE** **SP**			**GB**	**& Valedi-ctory**	Dinner

PS = Plenary Session., **PD** = Panel Discussion., **PL** = Public Lecture, **SPS** = Sectional Programme Symposia., **SP** = Sectional Programme., **CF** = Cultural Festival., **GB** = General Body., **SCE** = Sectional Committee Election., **SCM** = Sectional Committee Meeting., **SPL** = Sectional President's Lecture., **PJL** = Platinum Jubilee Lecture., **NL-YS** = Nobel Laureate and Young Scientists Interaction.,

95th Session of Indian Science Congress

PROGRAMME OF PANEL/ PLENARY SESSIONS

Date	9-00 a.m. - 10-45 a.m.	10-45 11-00	11-00 a.m. - 13-00 a.m.	13-00 14-00
04-01-08	*Biotechnology for well-being of all* **Coordinator & Co-Chair :** Dr. Krishna R. Dronamraju, Genetics Foundation, Houston, TX **Key note : Dr. Manju Sharma** Fmr Secretary, DBT, Govt. of India	Tea	*Space Technology for knowledge Dissemination :* **Coordinator & Chairman :** Dr. U.R.Rao, ISRO **Key note : Dr. G.Madhavan Nair** Chairman, ISRO & Secretary DOS	Lunch
	Biodiversity & IPR **Coordinator & Co-Chair :** **D**r. K. N. Ganeshaiah, UAS, Bangalore **Key note :** Dr.S.Kannaiyan, Chairman, NBA		*Transportation* **Co-Chairmen :** Mr.Ananth Prasad, Florida DOT & Mr. A.P.Bahadur, Govt. of India	
	Genomics & Society **Coordinators & Co-Chairpersons :** Dr. M.K.Bhan, Secretary, DBT & Dr. S.S.Parmar, USA Dr. P.R. Sudhakaran, Tiruvanantapuram **Lead speaker : Dr.Roger Kornberg, Nobel Laureate**		*Nanotechnology* **Coordinators & Co-Chairmen:** Dr. R. K. Verma (Bodh Gaya) & Dr. S. N. Sahu, (Bhubaneswar) **Key note : Dr. Robert Curl Jr, Nobel Laureate**	
	Evergreen Revolution **Coordinator & Chairman :** Dr. P.C. Kesavan, MSSRF		*Evergreen Revolution* **Key note :** Dr.M.S.Swaminathan (M.P)	
	Coping with water scarcity **Coordinators & Co-Chairpersons :** Dr.V.P.Sharma, M. N. Saha Fellow, NAScI		*Coping with water scarcity* (Continued.) Dr.K.J.Nath, Kolkata	
	Science for School Children : *Science Communication :* **Coordinators :** Dr.Anuj Sinha (DST) Dr.Raman, MSSRF		*Renewable Energy* **Coordinators & Co-chairmen :** Dr.JimWright(US)&Dr.P.Mohanty(BBSR)	
05-01-08	***1st.National Virtual Congress on'Mahila Kisan' Her Excellency Smt Pratibha Patilji Hon'ble President of India***		*Towards Nutrition Security of India* **Chairperson :** Dr.Rama Narayanan	

Date	9-00 a.m. - 10-45 a.m.	10-45 11-00	11-00 a.m. - 13-00 a.m.	13-00 14-00
06-01-08	*Science Education Content, Presentation & Purpose* **Coordinators & Co-Chairmen:** Dr.P.M.Bhargava (Anveshna) & Dr. Rao V. Avvagari (DST)	Tea	*Technology challenges for Domestic Water Security in Rural India".* **Coordinator & Co-Chairmen : Ms. Sunitha Nadhamuni, Arghyam**	Lunch
	Vedic Sciences **Coordinators & Co-Chairmen :** Dr. V.R.Panchmukhi, Chancellor, RSV Peeth, Dr. S. Sudarshana Sarma, Vice-Chancellor, S.V. Vedic University		*Brahman of Physics : Interface between Physics & Vedanta* **Coordinator & Co-Chair :** Dr.Rama Rao Pappu MU,Ohio,USA **Key note :** Dr.E.C.G. Sudarshan (Austin-TX)	
	Bioinformatics : **Coordinator & Co-Chair** Dr. A.Appa Rao, Andhra University		*Sustainability Science :* **Co-Chairmen :** Dr.V.N. Rasasekhar Pillai, VC, IGNOU Dr.S.K.Chopra, Delhi	
	Oceanography & Ocean Technology **Co-chairmen :** Dr. S.R.Shetye (NIO) & Dr.S.R.Durvasula (Canada)		*Current status of Viral Diseases & Control, Novel Management strategies* **Chairman:** Dr.Anupam Varma (IARI)	
	Global warming : Climate Change-Sea Level Changes **Chairpersons :** Dr. Ajay Parida MSSRF & Dr. T. S. Muurthy, Canada Key note address : Prof. M.S.Swaminathan—Lead talk : Dr. Jeffery Mc Neely, Switzerland			
07-01-08	*Public/Private/Industry Interaction* **Coordinators & Co-chairmen :** G.R.S. Rao (AGS, CPP) & Dr. Dwight Sangrey (USA)	Tea	*Public/Private/Industry Interaction* G.R.S. Rao(AGS,CPP) & Dr.Dwight Sangrey (USA)	Lunch
	Defence Science & Technologies **Coordinator & Co-Chairman :** Dr. V. Bhujanga Rao, Director, NSTL		*Defence Science & Technologies* **Key note :** Mr.M.Natarajan, SA to RM & DG, DRDO	
	Sustainable Fisheries & Marine Biotechnology **Coordinator & Co-Chairman :** Dr.S.Ayyappan, DDG(Fisheries) ICAR		*Bio-models in Medical Research* **Coordinator & Co-Chairman :** Dr. Pudur Jagadeeswaran UNT, Denton, TX,USA	
	Stem cells & Gene therapy **Coordinators & Co-Chairpersons :** Dr. Geetha Bali (Bangalore University) & Dr. D. Balasubramanian, (L.V. Prasad Eye Institute)		*E-learning, E-Governance and Telemedicine* / ISRO **Coordinator & Co-Chair :** Mr L. S. Satyamurty (Antrix, ISRO)	

Date	9-00 a.m. - 10-45 a.m.	10-45 11-00	11-00 a.m. - 13-00 a.m.	13-00 14-00
07-01-08	*Science Promotion : International Collaboration* NUS, Singapore, UNT, Denton, TX, Creighton University, Omaha, NE *Recent Advances in Agriculture* Chair & Key note **Dr.R.S.Paroda** Lead speakers : Dr. C. Ramasamy, VC, TNAU, Dr.V. Gowariker, Dr. D. S. Brar (Philippines)		*India' Energy Security* **Chairperson :** Dr. U. Aswathanarayana *Science for School Children & Science Communication :* **Coordinators :** Dr. Anuj Sinha (DST) & Dr.Raman, MSSRF Round Table for drafting recommendations of Panels	

LIST OF INVITEES INCLUDING NOBEL LAUREATES FOR SPECIAL / PUBLIC LECTURES

Sl. No	Name of the Scientist	Public Lecture	Title of the Talk	Date & Time
1.	Dr. R. Chidambaram. Scientific Advisor to Govt. of India	I	"Strategies for Innovation Leadership"	03-01-2008 14:00 – 14:45
2.	Dr. Roger Kornberg, (Nobel Laureate-Stanford)	II	Beyond Genes	03-01-2008 14:50 -15-35
3.	Dr. Paul Nurse (Nobel Laureate-Rockefeller)	III	'The Great Ideas of Biology'	03-01-2008 15:45 – 16:30
4.	Dr. M. S. Swaminathan MSSRF, Chennai	IV	'Towards Rural Knowledge Revolution'	03-01-2008 16:35 – 17:20
5.	Dr. M. G. K. Menon	V	Sustainability of Development	03-01-2008 17:25 – 18:05
6.	Dr. T. Ramasami (Secretary-DST)	VI	'Technology tools for Industrial Development in a sustainable Environment.'	03-01-2008 18:10 – 18:55
7.	Dr. Sam Pitroda (Chairman-NKC)	VII	'Towards Knowledge Based Society : What India needs to do' (not confirmed)	04-01-2008 17:25 – 18:05
8.	Dr. E. C. G. Sudarshan (Austin, TX)	VIII	"The Substratum of the Universe"	04-01-2008 18:10 – 18:55
9.	Robert Curl Jr (Nobel Laureate – Houston)	IX	'Elemental Carbon to the Development of Nanoscience and Technology'	05-01-2008 17:25 – 18:05
10.	Dr. M. P. Parameswaran,"Arunima", Kottapuram, Thrishur – 680 004. Kerala.	X	Taking Science to Society : "Bridging the Divides : Science in the Service of the Bottom Half"	05-01-2008 18:10 – 18:40
11.	Dr. P. M. Bhargava, 'Anveshna', Hyderabad	XI	Knowledge Vision(not confirmed)	05-01-2008 18.40-19.20

95TH SESSION OF INDIAN SCIENCE CONGRESS SECTIONAL SYMPOSIA

2.00 PM to 5.00 PM 4th to 7th Jan, 2008

Sl. No.	Name of the Section	Sectional President	Symposia
1.	Agriculture and Forestry Sciences	Prof.Biswapati Mandal mandalbiswapati@rediffmail.com 09433533598 Mobile 0091-3325826074 (R)	Soil Health : Its knowledge based maintenance for sustainable crop productivity and environmental quality
2.	Animal, Veterinary and Fishery Sciences	Prof.A.L.Bhatia, armbha@gmail.com 0091-141-2711304 (Res.) 98281 54287 (Mobile)	Challenges in 21st Century: (a) Bioterrorism (b) Perspectives of Radiation Biology (c) Animals & Animal Resources in Sustainable Science & Tech.
3.	Anthropological and Behavioral Sciences (including Archaeology and Psychology & Educational Sciences)	Dr.Upinder Dhar director@nim.ac.in upinderdhar@gmail.com 09879006850 (M) 079-40061160 (R)	Knowledge based society and quality of life.
4.	Chemical Sciences	Prof.N.K.Kaushik narenderkumar_kaushik@ yahoo.co.in 09818167997 (M) 011-27666987 (R)	1. Green Chemistry 2. Nanochemistry
5.	Earth System Sciences	Dr.V.P.Dimri director@ngri.res.in dimrivp@rediffmail.com 040-23434623 (R)	Challenges in Earth Science for 21st century : (a) Coastal Hazards (b) Water foot print – Quality and Quantity (c) Energy independence
6.	Engineering Sciences	Dr.Gurdip Singh, 9872200649 (M) ggscollege@yahoo.com	1. Redesigning Industrial Systems 2. Energy alternatives
7.	Environmental Sciences	Prof.V.K.Verma profvk-verma@yahoo.com 9818158495 (M)	1. Panel discussion : Climate Change 2. Symposium : Environmental remediation
8.	Information and Communication Science and Technology (including Computer Sciences)	Prof.A.K.Nayak akn-iibm@yahoo.com 09431018581 (M)	1. ICT for Rural Empowerment 2. Quantum computing 3. Bioinformatics
9.	Material Science	Prof.S.N.Sahu sahu@iopb.res.in 9437468884 (M)	1. Nanoelectric devises for Health Systems and for Pollution Control 2. Hard and Smart materials for defence applications

Sl. No.	Name of the Section	Sectional President	Symposia
10.	Mathematical Sciences (including Statistics)	Prof.M.R.Adhikari cms@cal2.vsnl.net.in cms_mra@yahoo.co.in 9830492677 (M)	Mathematical Sciences for advancement of Science and Technology
11.	Medical Sciences (including Physiology)	Prof.Col.Dr.Ranajit Sen ranajitsen_2007@rediffmail.com 9433078321 (M)	1. Nutrition : Maternal and Fetal 2. Infectious diseases
12.	New Biology (including Biochemistry, Biophysics and Molecular Biology and Biotechnology)	Prof.P.R.Sudhakaran prsudhakaran@vsnl.com 0471-2432514 (R)	1. Interface between Biology & Health. 2. Genomics and Society
13.	Physical Sciences	Prof.Lalan Jha jlnphylnmu@yahoo.com 9431654395 (M)	Broad Band Communication
14.	Plant Sciences	Porf.S.V.S.Chauhan svs250@rediffmali.com 9412257761 (M)	1. Role of plant reproductive Biology in Biodiversity conservation 2. Sterlity in plants and its utilization in Hybrid Seed production.

Conferences / Meetings / Symposia / Seminars

29th Annual Meeting of Plant Tissue Culture Association & National Symposium on Plant Biotechnology for Conservation, Characterisation and Crop Improvement, February 8-10, 2008, Department of Biotechnology, Mohanlal Sukhadia University, Udaipur, Rajasthan.

During the symposium following two special sessions will be held. A. Commercialisation of Biotechnologies in India B. Medicinal and Aromatic Plants Research in India. The Symposium is open for participation by scientists, educationists, industrialists and students interested in biotechnology.

Contact : **Professor Sunil D. Purohit,** Organizing Secretary, Post Box No. 100, Department of Biotechnology, Vigyan Bhawan, Block B, New Campus, Mohanlal Sukhadia University, Udaipur 313001. Telefax : 0294-2410300, e-mail:sdp_56@hotmail.com.

National Symposium on Ecofriendly Insect Pest Management, February 7-8, 2008 Chennai

The Symposium aims to discuss the developments in the field of ecofriendly insect pest management. The topics to be discussed are (i) Preparation and application methods of new formulations of botanical and microbial pesticides (ii) Mass rearing techniques, field evaluation and conservation of biocontrol agents (iii) Cultural control measures (iv) Vector control (v) Genetic techniques (v) Phermones, attractants and repellents.

Contact : **Dr. S. Ignacimuthu,** Director, Entomology Research Institute, Loyola College, Chennai-600034, Tel : 44 2817 4644, e-mail : eri_lc@hotmail.com

International Conference on Data Management, February 25-26, 2008, IMT Ghaziabad

All orgnizations depend on the accurate and timely presentation of information to employees, customers, suppliers, shareholders and the government for their survival. Many people and organizaions are still holding on to older models of data management that fail to avail the full power of PC and other enterprise applications. Managing data from multiple sources including external downloads, data links and manual data entry is challenging for any corporate. Cheap, powerful computing and networking have created countless new applications that could not have existed a decade ago. The advent world-wide Web and its influence in driving the Internet into homes and business, is one obvious example.

Data Management is the process of planning, coordinating and controlling an organization's data resources. More often, applications need to store and search a large amount of structurally complex data. Managing

data has been continuously challenged by demands and various areas and applications and has evolved in parallel with advances in hard computing techniques. New applications, issues and emerging technologies such as Warehousing and Data Mining, Bioinformatics, Multimedia databases, Object-oriented Databases, Trust Management and Security has compelled database specialists to revisit areas of data modeling, query languages, storage and internet compatibility the convergence of high performance computing, global high-speed communications advanced sensing and data analysis is driving the next wave of information-age business transformation. The Conference would attempt to identity, document and explore the issues and problems challenging Data Management.

Contact : Garg **Dr. Jayanthi Ranjan and Dr. Poonam Garg,** Associate Professors-Information Technology and Management Area, Conference Chairs, Institute of Management Technology, Rajnagar, Ghaziabad, Uttarpradesh-201001 E-mail : icdm2008@imt.edu.

S & T ACROSS THE WORLD

CHINA'S SPACE PROGRAMME

China has outlined its space programme for the next few years till 2010.

The Programme is among the goals published by the Commission for Science, Technology and Industry for National Defence in its 11th Five Year Plan (2006-10) for space science development.

According to these plants, a Moon orbit is slated for 2007 to acquire 'three-dimensional pictures', which will be followed by rendezvous and docking of the space craft. In 2009, the launch of the Shijian (Practice)-10 scientific recoverable satellite is scheduled for conducting micro-gravity and space life experiments, and in 2010 the development of a space laboratory and space walking by Chinese astronauts is planned.

Other plans include participation in the space environment exploration programme, research on a solar telescope and a comprehensive research programme on the sun.

(News from China, Mar. 2007)

KALEDO DESIGN MANAGEMENT SOLUTIONS

Lectra, the world leader in software, CAD/CAM equipment services dedicated to large scale users of textiles, leather and industrial fabrics, announced its participation in SPESA Expo 2007, which was held on May 8-10 2007 at Miami Beach, Florida, USA.

Among the latest innovations unveiled was the Kaledo Design Management Solution, which provides designers with an intuitive working environment in which necessary data is readily accessible. In the current climate of constantly changing styles, this new offering allows companies to accelerate design processes in order to launch products that keep up with fashion trends and satisfy consumer expectations. It also enhances communication between designers and external and internal collaborators.

The Kaledo concept allows for the structuring of the creative process, providing intelligence and encouraging creativity and innovation, while facilitating collaboration between designers and the various players involved. With Kaledo, designers can create their collections ; all models, styles, components, and other details are stored in the application's memory, and each modification to a style, colour, or fabric is automatically updated.

(Lectra Press Release, May 3, 2007)

DATABASE FOR NUTRITIONAL FACTS

As problems associated with being overweight and obese are causing worldwide concern, help is at hand in the form of a new online database which aims at helping consumers understand the nutritional content of their food products better and as such curb excess fat or calorie intake.

In the USA, an estimated 66 percent of adults are either overweight or obese, and the rate of obesity has more than doubled from 15 percent in 1976-80 to 32.9 percent in 2003-04. While nutritional fact labels were designed to help consumers make wiser decisions in the market, surveys have shown that the public is quite confused about them. For instance, among the findings were that only 37 percent of consumers could calculate the number of calories in a 20 ounce bottle of aerated drink.

The new free, and online database launched by Atlana, Georgia-based Nutrition Systems and named *Nutrition Pedia.com*, will enable the public to access nutrition fact labels for over 50,000 food

products. It is designed to encourage consumers to compare nutritional information regarding food products and it could well motivate manufacturers of these products to minimize the unhealthy content of these foods.

The website also contains tips on dieting and good health maintenance.

(Meat Process.com, Jun. 18, 2007)

INNOVATIVE TREATMENT OF HEART ATTACKS

Doctors in Calgary, Canada, have reported that a multidisciplinary team approach involving emergency medical services, emergency physicians, cardiologists, and speciality centres, has a better chance of successfully treating acute heart attacks than a single line approach.

Recent standards of "door to balloon" time for treating and reversing heart attacks has challenged emergency services, requiring pre-hospital diagnosis of heart attacks and commencement of specialized treatments (interventional cardiology) within just 90 minutes. The standards relate to ST-segment elevation myocardial infarction (STEMI-a common type of acute heart attack that can easily be recognized on an ECG).

The Calgary programme used a pre-hospital diagnosis and expedited transfer of patients directly to a facility offering specialized treatments. This allowed ambulances to bypass a time consuming trip to regional hospitals.

In a related development, another specialist has reviewed the recommendations for emergency treatment of STEMI and difficulties in coordinating the different healthcare personnel in order to achieve the required "door-to-balloon" time in Canada.

(EurekAlert, Jun 18, 2007)

ANSWERS TO "DO YOU KNOW ?"

A1. Planet Mars-24 hours 37 minutes.

A2. 75 Trillion.

A3. Almost 30,000 metric tons.

A4. Three. The earth spins like a top, it travels around the sun and it also moves through the Milky Way Galaxy with the rest of the solar system.

A5. To escape the Gravitational pull the minimum velocity required is 11.18 cm/sec, i.e., 40,248 km per hour.

A6. In the core it is about 6300. C=almost as hot as the surface of the sun.

A7. About 600.

A8. It is the scientific name of pineapple

भारतीय विज्ञान कांग्रेस संस्था

14, डा० विरेश गुह स्ट्रीट, कोलकाता 700 017, भारत

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata-700 017, INDIA

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

Terms of Membership and Privileges of Members :

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

1. **Member :** A person willing to be enrolled as new 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 subscription 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, reprint of the Proceedings to Session of any one section of their interest and also the bi-monthly journal of the Association "Everyman's Science".

2. **Sessional Member :** Sessional members are those who join the Association for the Session only. A Sessional Member has to pay a subscription of Rs. 250/- (for foreign U.S. $60) only.

3. **Student Member :** A person studying at the under-graduate level may be enrolled as a Student Member provided his/her application be duly certified by the Principal/Head of the 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. **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.

**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.*

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 of the Association's journal "Everyman's Science".

6. **Donor :** Any person paying a lump sum of Rs. 10,000/- (for foreign U.S. $5000) only, can become a Donor of the Assocaiation. 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 ***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 as also the Association's journal "Everyman's Science".

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 Sectional President General Secretary (Hqrs) Latest by *September 15*, each year.

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.

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.

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

Note : All Money Orders, Bank Drafts etc. should be drawn in favour of "*Treasurer, The Indian Science Congress Association*". Members are requested to mention their Card No. while making any correspondence to ISCA office.

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

भारतीय विज्ञान कांग्रेस संस्था

14, डॉ० विरेश गुह स्ट्रीट, कोलकाता 700 017, भारत

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata-700 017, INDIA

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Website : http://sciencecongress.nic.in
Fax : 91-33-2287-2551
E-mail : iscacal@vsnl.net
iscacal_2004@yahoo.com

APPLICATION FORM FOR MEMBERSHIP

To
The General Secretary
The Indian Science Congress Association
14, Dr. Biresh Guha Street,
Kolkata-700 017

Stamp Size Photograph

Dear Sir,

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

I am sending herewith an amount of Rs. ..... in payment of my subscription by Bank Draft / Money Order / Cash for Membership / Life Membership Subscription / from the year 1st April 200 ..... to 31st March 200 .....

I am interested in the following section (Please tick any one).

SECTIONS

1. Agriculture and Forestry Sciences
2. Animal, Veterinary and Fishery Sciences
3. Anthropological and Behavioural Sciences (including Archaeology and Psychology & Educational Sciences)
4. Chemical Sciences
5. Earth System Sciences
6. Engineering Sciences
7. Environmental Sciences
8. Information and Communication Science & Technology (including Computer Sciences)
9. Materials Science.
10. Mathematical Sciences (including Statistics)
11. Medical Sciences (including Physiology)
12. New Biology (including Bio-Chemistry, Biophysics & Molecular Biology and Biotechnology)
13. Physical Sciences
14. Plant Sciences

(Please type or fillup in Block Letters)

Name (in block letters) : _____ SURNAME _____ FIRST NAME _____ MIDDLE NAME

Academic Qualifications :
(Evidence to be submitted)

Designation :

Address for Communication :
(including State, City/Town and Pin code)

Phone No. & e-mail

Permanent Address :

Yours faithfully

Date : Signature

- *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 form "care of" address is given then there should be also signature of the person in whose name "care of" is given.*
- *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.*