# EVERYMAN'S SCIENCE

**Vol. XLVI No. 1 (April '11 – May '11)**




**COVER PHOTOGRAPHS**

***Past General Presidents of ISCA***

| | |
|---|---|
| **1. Dr. Atma Ram** | **(1968)** |
| **2. Dr. A. C. Joshi** | **(1969)** |
| **2. Prof. A. C. Banerjee** (died pre-maturely) | **(1969)** |
| **3. Prof. L. C. Verman** | **(1970)** |
| **4. Prof. B. P. Pal** | **(1971)** |
| **5. Prof. W. D. West** | **(1972)** |
| **6. Dr. S. Bhagavantam** | **(1973)** |






**Printed and published by Prof. S. S. Katiyar on behalf of Indian Science Congress Association and printed at Seva Mudran, 43, Kailash Bose Street, Kolkata-700 006 and published at Indian Science Congress Association, 14, Dr. Biresh Guha Street, Kolkata-700 017, with Prof. S. S. Katiyar as Editor-in-Chief.**

***Annual Subscription :*** **(6 issues)**

**Institutional ₹ 200/- ; Individual ₹ 50/-**

**Price : ₹ 10/- per issue**

# CONTENTS


| | |
|---|---|
| **EDITORIAL :** | 3 |
| **ARTICLES :** | |
| **Presidential Address : Science in India — Some Aspects** | |
| *Dr. Atma Ram* | 6 |
| **Ultrasonic Technology for Food Industry** | |
| *Krishna Murti Raju, Ritesh Prajapati and Rudra Kant Srivastava* | 20 |
| **Swine Influenza – A Global Threat** | |
| *S. Parthiban and H. K. Mukhopadhyay* | 24 |
| **Chemistry of Dendrimers : Numerous Applications in Real Life** | |
| *H. Shekhar* | 28 |
| **KNOW THY INSTITUTIONS** | 34 |
| **LIFE SKETCHES OF OFFICE BEARERS AND SECTIONAL PRESIDENTS** | |
| **ISCA, 2011-2012** | 38 |
| **CONFERENCES / MEETINGS / SYMPOSIA / SEMINARS** | 55 |
| **S & T ACROSS THE WORLD** | 58 |

# EDITORIAL

## ON THE NEED FOR COMBINING SCIENCES, SOCIAL SCIENCES AND HUMANITIES

The Eleventh Five Year Plan has envisaged a revolution in the Science and Technology education in the country. A large number of institutions devoted to technology, management, science and other professions have been planned. Several of them have started functioning and several others are in the planning stage. In this context there is a need to think about processes of differentiation and de-differentiation in knowledge. Time has come to integrate different forms of knowledge so that they can serve the needs of mankind in general and the needs of Indian society in particular.

In modern India, the knowledge systems in India have maintained a clear hierarchy: technology at the top, science in-between, and social sciences at the bottom. In Indian mind literature and philosophy are often outside the "useful knowledge" system. As a consequence of separation between technology, science and social sciences in the country both sciences and social sciences have suffered. On the scientific front this has produced more of a dependent science: science that serves the needs of the international capitalism rather than the needs of the Indian people. Barring a few exceptions, the prestigious science and technology institutions define goals of teaching and research more in the international science framework rather than in the Indian social framework. Oblivious of the needs of their own people Indian scientists aspire to publish papers in the international journals accepting the international chains of inequality between scientists and scientific institutions. For the young minds, therefore, to look for advancement is to look for publications in the "high-impact" journals. In most areas of science Indian journals are rated badly and no serious researcher wants to publish in them. This is connected with another problem – the feudalism of the Indian scientific community. A common, young researcher believes that without patronage of an established scientist it is impossible to publish in the Indian journals. When a Central Minister or a political leader says that the leading institutions are failing in attaining their goals, or that they are contributing more to the world science than the Indian science, faculty members connected with them are hurt and tend to react angrily but the reality is not very far from what is said. There is a dire need to connect science to everyday problems of Indian society to make it relevant for people.

Further, the separation of social sciences from science and technology has created a situation which has prevented growth of social sciences and has almost killed humanities. Few parents wish that their children pursue social sciences or humanities. Social scientists have fewer employment opportunities, lower salaries, and lesser prestige in society. They also exercise lesser power than scientists and technologists. Their existence is marginal to knowledge, politics and planning. The result is unfortunate: high (often unlimited) enrollment in universities but poor quality of instructions, absence of research, and absence of original and creative thought. One rarely meets social scientists in colleges and universities who have something meaningful to say on the social problems of their city, e.g., poverty, crime, divorce, unemployment, migration, corruption, population

growth, communal conflicts and social integration. This is equally true that administrators and Non-Government Organizations (NGOs) dealing with real world problems too lack appreciation for knowledge of local experts and are unwilling to contact them to seek local solutions. Completely cut off from surroundings, social scientists have become a burden on knowledge resources. At a time when society is looking for solutions to multiple problems facing the nation, there are few social scientists worth the name. You may have some celebrities at the national level, mostly deriving legitimacy from linkages with international social sciences, but few responsible social scientists available at the village, block or district level.

Some institutions like IITs began with laudable aims. Right from the beginning they had a strong component of Humanities and Social Sciences (HSS). In IIT Kanpur the first professor was appointed in HSS and not in engineering. A few universities like Jawaharlal Nehru University (JNU) too have experimented with the idea of inter-disciplinary centers of teaching and research. The experiment has served well. In terms of training of young social scientists in diverse areas some old IITs are doing quite well. They have sensitized undergraduate students of technology and sciences to social context, and also to the best humanistic ideas from the West and the East. In terms of quality of research they are doing as well as the best universities in the country, and sometimes better. However, they too cannot boast of significant contribution to Indian society or everyday problems of Indian people. In relation to the resources available in the IIT system their achievements cannot be called optimal. HSS faculty is rarely part of big research in energy, environment, transportation, biological sciences, and rural development initiatives even when their contribution could be substantial. Moreover, lacking access to established channels of funds and priorities, and favorable (flexible) work environment they spend most of their time on teaching and committee work. Something gets done but certainly much more could have been done. The sub-optimality of results is again due to the same reasons: compartmentalization of knowledge, separation of social sciences and humanities from technology, politics of resources and recognition, and knowledge hierarchies outside and inside the department.

The issue is: how can this situation be redeemed? The country needs a value based, integrated knowledge framework in which all knowledge systems are rated equally and are joined together to respond to concrete problems of Indian masses. Here it is worth mentioning that some IIITs, particularly IIIT Hyderabad, are experimenting with discipline-free knowledge climate in which people from diverse backgrounds work at the same place to solve concrete and complex problems in a specific domain having a broad vision of teaching and research. This has brought together people from as diverse areas as computer science, cognitive science, philosophy, sociology and others. They are working together on various technological and human problems. Learning from their experiences, time has come to establish centers of teaching and research with distinct value systems which welcome contribution from all – computer scientists, chemical engineers, mathematicians, sociologists, economists, and philosophers working on business ethics. The goal is to identify innovative solutions for poverty, unemployment, exploitation, dominance and oppression in the framework of human values.

It can be argued that three knowledge maladies which are closely connected with the disconnection between technology, sciences and social sciences are: (a) knowledge elitism that separates experts

from laymen in social relations as well as in social representations; (b) lack of self confidence in identifying innovative and relevant research problems and pursuing them devotedly for a long time; and (c) a feeling of alienation and marginalization. In social matters it is difficult to identify unique and asymmetrical relationships as all system variables affect each other simultaneously in complex ways, yet the differentiation and stratification of knowledge systems seem to be a significant cause of each of the above three problems. It is time that we wake up to take a few bold steps: (a) make the young scientists interiorize the values of equality and humanism; (b) give them confidence and resources to work on their own (relevant) problems for a long time; and (c) train them to work in teams. Let the traditional divisions of departments and schools go and new centers of excellence be created to provide opportunity to younger generation to solve problems of Indian society and to solve their own problems.

***A. K. Sharma***

***Science belongs to no one country.***

***— Louis Pasteur***

***PRESIDENTIAL ADDRESS***

# SCIENCE IN INDIA — SOME ASPECTS

DR. ATMA RAM, D.SC., F.N.I.

Before sharing some thoughts with you, may I express my gratitude to the members of the Indian Science Congress for having elected me as their President. I am, at once, conscious of the high honour bestowed on me by the largest body of scientists in this country and the heavy responsibility associated with it. While fully aware of the responsibility, the confidence you have reposed in me arms me with courage and strength to face a task which would have normally filled me with diffidence especially as my predecessors in this high office have been great men of Science.

The historic city of Varanasi is an attraction to any one. To millions it is a place of pilgrimage. To me it is homecoming; it is an opportunity for me to draw fresh inspiration from my *alma mater* which owes so much to the great and noble son of India, Mahamana Pandit Madan Mohan Malaviya. Pandit Malaviya, well-versed in the scriptures, was a great patriot and he realised that the study of Science and technology was essential for the progress of the country. With foresight, he established a number of departments of technology and engineering in this University at a time when emphasis was on arts and humanities. His note of dissent to the report of the Indian Industrial Commission (Holland Commission) of 1916 showed how conscious he was of the need to develop Science and technology in India. Let us revere his memory.

I have been thinking of what is expected of the Indian Science Congress. As you are aware, this Congress follows the pattern of the British Association for the Advancement of Science. Like that Association, we also aim at establishing live contact between scientists and the people. The general image of scientists that they are far from the understanding of the common people working in some sort of ivory tower should be erased if this live contact is to be established. As Science and technology affect lives of ordinary men and women, it is essential for scientists to put across to the people what they are doing and also get to know the thinking and viewpoint of the people. This, in my opinion, is one of the primary functions of the Science Congress. On the eve of one of the early sessions of the British Association, a leading British newspaper asked the question "When shall this monstrous bubble burst?" The very same Daily became in due course an ardent supporter of the British Association. We too have our critics and supporters.

The Indian Science Congress is about 55 years old. It is time we reflected on what we have been doing and how well. The need for introspection was stressed by my distinguished predecessor, Prof. T. R. Seshadri at the last session. It is already engaging our attention and some reorientation of the activities of the Association has taken place. I hope from this session, some newer and fresher

* General President, Fifty-Four Indian Science Congress held during January, 1968 at Varanasi.

ideas will emerge which will aid the direction of our activities into fruitful channels.

**ROLE OF SCIENCE IN A DEVELOPING SOCIETY**

Ever since independence, this Congress was fortunate in having Shri Jawaharlal Nehru inaugurate and participate in almost all sessions. We also had the privilege of having him as one of our Presidents. His enlightened leadership accelerated the pace of scientific progress in this country by moulding the attitude of the Government and the people to Science. At one session he said.

> "My interest largely consists in trying to make the Indian people and even the Government of India conscious of scientific work and the necessity for it".

His constant reminders for the need of scientific temper leave us with a sense of gratitude to him.

It is our good fortune that Mrs. Gandhi also has deep interest in Science and the scientific method. We are beholden to her. With her abiding interest in Science and technology, I am sure, these will take long strides and play their part in the life of the country. It is significant that she should have chosen one of us, Dr. Triguna Sen, as Union Minister to look after scientific affairs. Coming with a sense of fulfilment from this University, he has already aroused great hopes of fulfilment in a wider field. We look forward to his continuing support and encouragement. We are indeed happy that Dr. A. C. Joshi, also one of us, is the Vice-Chancellor of Banaras Hindu University at this time. I must thank him for the personal attention he has given to make this session a success.

We are meeting at a time when Science is on the threshold of a very exciting era. Last year, for the first time, the opaque atmosphere of Venus was pierced and man-made instruments were landed on it. This achievement is indeed exhilarating and the Indian Scientists will no doubt join me in congratulating the fellow scientists responsible for this historic achievement. This however strikingly reminds us that whereas the problem in the developing countries is how to make man walk well on earth.

Why did Nehru give so much importance to Science in India ? Why are we making substantial investment in scientific and technological research? And why are we encouraging more and more scientific endeavours ? In short, what are the objectives in our support to Science ?

The consideration of these questions brings two aspects to the fore; firstly, the value of Science in developing rational thinking and widening knowledge so essential for a society in transition; and secondly, its economic and social significance. Science, and technology which is sustained by Science, provide us means for development of industry and agriculture, give us knowledge and ability to improve communications, endow us with better health through eradication of disease and, in short, give us a better standard of living. Science in the contemporary world is an important tool of human well-being even as capital, labour and enterprise were in the world of yesterday. Never before had man so much knowledge and technique at his command for his well-being. It is this promise which Science holds for the people that makes it important. Indian scientists, therefore, have the inalienable responsibility to contribute to the good of the community. What else could be the function of scientists in a developing society ? The question we should ask ourselves is, "How near are we to our people, and how relevant is our work to their hopes and aspirations ?"

Our research and development should be closely linked and contribute to economic growth. Prof. P. M. S. Blackett, President, Royal Society, London, in his recent Nehru Memorial Lecture has very appropriately said, "The present poverty is so great and the task of dealing with a rapidly rising population is so formidable that almost everything must be sacrificed to economic growth. Economic

growth is not everything; but today in India, it is almost everything". I am in full agreement with this view. In this context, the test for research and development is the extent to which it is put to use in productive enterprise. In India, where research and development is mostly confined to Government sponsored establishments and utilisation of results has to be in industry in public or private sectors, there is a hiatus. This is understandable as even when both are under the same auspices, there is usually resistance to innovation from the shopfloor. This dichotomy of research and production is a weakness. The best disposition is research by industry in industry. In spite of tax incentives to industry to undertake its own research and C.S.I.R's offer to contribute towards industrial research associations on a cooperative basis, research by industry has not been growing sufficiently fast. In this year's budget, the Deputy Prime Minister Shri Morarji Desai has enhanced the concessions on taxation on moneys spent for research by industry. I hope, industry will take full advantage of these opportunities. It will help them as well as the country. Research not only in our national laboratories and other research institutions but also in our universities should desirably be relevant to the country's needs. For, as Sir Francis Bacon pointed out, "The true and lawful goal of Science is that human life be endowed with new powers and inventions and be operative to the betterment of man's life".

For centuries, technology and Science remained and developed independent of each other. Technology, known as industrial arts, was essentially empirical and provided little interest to the intellectual classes who generally looked down upon it. As an offshoot of organised human thought, Science appealed to the intellectual classes and remained their preserve and pass time. It was only about the middle of the nineteenth century that Science and technology came closer to each other and it was realised that each stimulated the growth of the other. With the progress of organised knowledge in many areas, Science and technology have lost much of their distinctiveness. Technology is now more Science-based than ever before.

I think, it will be of some benefit to us in this country to appreciate the distinct roles of Science and technology. Though in a well-developed economy this distinction is not of great significance, in the present stage of our nation's growth, it is important. For, it is on this distinction that we have to base our strategy of development of Science as well as technology. Our present need calls for greater emphasis on technology.

As today's Science may lead to tomorrow's technology, we must promote and sustain Science in all its aspects. Those with a vocation for Pure Science must be able to pursue it. To apply Science, one must first know it. Hence, pursuit of Pure Science must be encouraged in all its varied branches. But in doing so, the highest international standards should be observed. It is essential to have a healthy growth of basic Science and research should be conducted at the very frontiers of knowledge. For this reason, the universities which are the principal centres of basic work must be strengthened. One of our primary aims in this regard should be the development of what I would term "scientific capabilities".

In passing, I wish to mention that the experimental aspect is not sufficiently emphasised in our Science teaching. Cultivation of experimental ability need not solely depend upon sophisticated equipment or ready-made apparatus. Improvisation is what should be encouraged; it is this which leads to innovation and often to discoveries. In any case, it develops skills and machine sense. This will also help in orienting our education system to production.

Our country had had a great tradition of intellectual activity; in many fields of Science our forefathers made some great contributions to the

growth of knowledge. But such knowledge mostly remained unrelated to social needs. Later, in Science, as in many other fields of creativity, a stasis set in. Several historical forces made us, along with other oriental peoples, backward. Science and technology became almost foreign to us. The Indian renaissance in the latter half of the nineteenth century, which began with the pioneering efforts of Raja Ram Mohan Roy, caused a literary and cultural upsurge in the country motivated by the desire of a subject nation to attain intellectual equality with their masters. This movement which reached its height in Rabindranath Tagore also re-established the scientific tradition in India throwing up many distinguished scientists, pure and applied, around whom centres of excellence grew. This gave the lie to the view, popular in the West, that the eastern mind was essentially metaphysical and unsuited to Science and technology. With independence, public support was ensured for rapid institutional growth and heavy investments were made up the Government whose policy in relation to Science was most ably put forward in the famous Scientific Policy Resolution of 1958.

While we have a Scientific Policy Resolution, is there a national resolve of dedication to Science ? How is it that the fire and enthusiasm, which produced outstanding men who could walk shoulder to shoulder with their compeers elsewhere, have dampened ? Before independence, we had a goal. What is the goal now ? Are we now resting on our past laurels ? How is it when insignificant sums of money were available compared to what we get now, we did so well ?

At a juncture when emphasis is on technology, we do not have a clear statement of technological policy as we have of Science and industrial policies. A technological policy statement which will link our Science and industrial policy is vitally necessary. This will give practical shape to many aspects of our scientific policy and provide guidelines for our industrial policy. Such a statement would have to consider, among other things, the following.

1. Modern technology is capital intensive and labour saving. Conditions in India are just the opposite; capital short, labour afficient. She is particularly short of foreign exchange. The question would be, what technology should be selected ? The test should be suitability to our needs than superiority, so as to avoid creating social imbalances and unemployment. In adapting technologies considerations of prestige should have no place. Contrary to general belief, Japan has shown that non-automatic technologies are not necessarily primitive nor that sophistication need necessarily be automatic.
2. In what fields should the country seek and obtain know-how ? And what are those in which our institutes could be assigned the task of developing know-how and processes ? In obtaining know-how there are many aspects which are interrelated and which need careful consideration. For producing consumer goods, we should rely more on labour intensive technologies.
3. What should be the degree of sophistication in relation to our needs? In certain fields, such as steel-making, basic chemicals, defence and health, we must have the very best, and economy of scale must be ensured.
4. The relation of technological policy with the availability of raw materials is important. In international commerce, we should identify those items where we can enjoy competitive advantage and in such cases we should use the best techniques. For instance, we should have given concentrated attention to research related to jute, tea and textile industries which have been our major foreign exchange earners.

There may be other similar questions. These should be carefully considered and should form

part of a statement of technological policy. There has been some thinking on these issues and policy decisions have been taken in regard to some of them. But a look at the problem in its entirety is needed to bring them together within the ambit of an integrated national policy statement on technology.

## IMPORTANCE OF DEVELOPMENT OF HUMAN RESOURCES

The Scientific Policy Resolution is a well-drafted statement of intentions. We are yet to work out a strategy of development. One often hears the description of India as a poor rich country; we are rich in our resources and potentials but our people are poor. A developmental strategy for India would consist of three essential elements; comprehensive survey of our physical resources and their exploitation, encouragement to capital formation and enterprise; and development, of human resources. It is a simultaneous progress in all these three fields which can make our country really rich.

Of these, the development of human resources is pivotal. Economic growth needs capital, technological and economic know-how, managerial ability, modern industrial skills and the will to work hard. Except capital, all these relate to human resources. We know of countries with inadequate capital having made remarkable progress on the strength of their human resources. No country in the world can be self-sufficient in its physical resources. History provides instances where unwise human activities have rendered otherwise prosperous countries barren.

The development of our country can only come the hard way. Inflow of capital and assistance from abroad in various forms can at best be a catalyst. Unless forces are generated within the country based on scientific and technical skills, entrepreneurial talents and forward-looking social attitudes, we will not be able to have the proper infrastructure of development. How are these growth forces to be generated ? Obviously, by developing human resources. If investment in physical resources pays off, investment in human resources pays off many times over. Human resource development is not merely education, though education plays an important part. Education provides the base on which we have to build a superstructure of skills and capabilities which transform physical resources into wealth. The training of scientists, technologists and engineers, technicians and craftsmen, managerial and administrative personnel and a host of professional and non-professional men of skills is essential for the growth of the nation. Have we adequately tackled the problem of development of skills, competence and capabilities which produce wealth ?

While dealing with skills, I would like to mention the continuing neglect of technicians in our country. More sophisticated the production, the more its dependence on technicians and scientifically trained workers. Industrial production which is becoming increasingly mechanised and elaborate, needs a highly skilled work-force to operate, maintain and repair equipment, test and inspect raw-materials and products, design and construct new machines and develop new products. These highly technical tasks of industry need men with wide and deep technical training. Our society has not given the technicians the recognition they deserve. Their contribution to economic and social progress is as significant as that made by other professional groups of the community.

## PLANNING AND ORGANISATION OF SCIENCE

Since we began to organise and expand Science in a big way, problems relating to organisation and planning of Science have held our attention. These are : How should Science be organised ? What is the position of individual scientists in such an organisation ?

A certain minimum organisation is necessary in any human effort. In Applied Science directed towards the solution of specific problems which need large resources of men and material, organisation is inevitable. But organisation of work alone does not always lead to creativeness. Great discoveries are as unexpected as unplanned. Development which has very specific objectives should be as fully organised as possible. Applied research laboratories fall between these two extremes and organisation of their research does not conform to a fixed pattern. It varies from laboratory to laboratory depending upon to which end of the spectrum it is close.

In modern research laboratories, management is considered an important aspect. There are no well-recognised or standard methods of organising or managing industrial research. Yet, industrial research has been a great success and has progressed very far. There is a view that the relatively unsuccessful attempts to work out satisfactory formulae for organisation of industrial research have, ironically, contributed to its success. We should, nevertheless, be aware of our problems and constantly endeavour to improve our methods of organising research. But to think of straight-jacket methods and to expect to find solutions made-to-order will be expecting too much. While books, seminars and symposia will continue to pour out thoughts and theories on the management of research, the very dynamism of Science makes its management a continuing problem. All methods evolved have to be tentative and tested in the crucible of experience. In any case, in our country we should spend less time organising and more time doing research.

The next question is "What should be the place of the individual scientist in this age of team work?" The popular belief is that modern research is a team work and the days of individual accomplishments are over. Whether it is a team or a committee that functions, ideation is essentially the result of individual intelligence. It is the sudden gleam in the laboratory of the human mind that generates ideas which lead to basic contributions. Committees did not discover penicillin or invent the jet engine. The emphasis on team work and committee work inevitably leads to overall organisation and planning. It is doubtful if one who is busy organising and planning has the time to think Science. A team of scientists can be guided and inspired only by an active scientist intimately in touch with and participating in the work at the bench. These views may not be to the liking of Science planners who are deeply worried to find the ideal way of organising effort, avoiding overlapping, preventing duplication and similar other problems.

After completing my university career under the affectionate guidance of Prof. N. R. Dhar, I came under the spell of Prof. Meghnad Saha. I was privileged to collaborate with him in the work of the National Planning Committee. In recent years, Dr. Shanti Swarup Bhatnagar planned and organised Science in a big way and I was associated with him for fifteen years. Later, I came in contact with Prof. P. G. Mahalanobis in matters of planning. My experience has made me a strong believer in the essentiality of planning for development. After having spent 36 years of my life in research I have been a recruit to Delhi for about a year. I have watched and participated in numerous meetings and committees. If one kept a record of the terminology used in many of these discussions, one would come across phrases like long-term, short-term, phased programme feedback, crash programme, spill over, and infrastructure. But where do they lead us to ?

In those aspects of Science where planning is important we have hardly begun. We have not yet evolved a method of working out priorities or a system for the allocation of funds. At present, work programmes are formulated by institutions and a collection of such programmes becomes a plan. There is no scientific body to determine the

priorities or to lay emphasis on various areas of research or to frame guidelines for allocation of funds. It is important that some mechanism should be established to ensure that the total amount of money invested in scientific research in our country is so laid out as to yield the maximum benefit to the country. This will ensure that money is not diverted to prestigious projects or to projects of lesser social and economic importance at the expense of some vital needs of the country.

The increasing tendency in laboratories to "democratisation" is a direct outcome of and reaction to the concept of planning and organisation. Each worker in a laboratory wants to have a say in decision-making. What is the extent to which democratic process can be applied to the functioning of a laboratory ? It is in inverse proportion to the stature and respect the leader commands among his fellow scientific workers. Various democratic departmental procedures have been evolved in many laboratories. Any number of committees and panels are appointed for every conceivable purpose ; for library, for workshop, for stores, for purchase and even for space allotment. Various forms and proformae are devised and scientists at the bench have to spend time filling them in. Excessive departmental democracy can be time-consuming and may, in effect, impede research. What is needed really is an intelligent appreciation of the views and needs of the research worker at the bench. In all our discussions on organisational problems of scientific research in India, the point of view of the research worker at the bench is sadly neglected. All other points of view are amply and vociferously put forward, particularly the point of view of the men at the top.

Before I take a different tack, I may refer to the relation of administration and Science. It has been taken for granted, it appears, that scientists and administrators lack sympathy for each other's point of view. Our present administrative system was devised by a ruling class for a subject people. Since independence, this system has undergone some changes but not radical enough to satisfy the yearnings of an independent people. But the system has permeated deep. A rapid change will not be free from pangs. I think what ultimately matters is not so much the system of administration but the man behind it. In the hands of an enlightened and competent administrator, even an inadequate system can work to advantage. Impediments cannot deter one who wants to accomplish. No administrative manual can shape the behaviour or skill of an administrator. Under an indifferent administration wrongs can persist as procedurally correct. In the hands of the incompetent, the right can go under. I, therefore, attach far more importance to the choice of proper men in administration. As days go by, the generalist administrator will be replaced by technocrats; a new system and a new relationship are bound to emerge and with them new stresses and strains.

Often, the question of autonomy in scientific institutions is raised. The stress has generally been on autonomy for spending. But, I would prefer to emphasise intellectual autonomy, and it is this autonomy that I would like scientists to be assured of. Throughout my career starting as a Research Assistant, I have not had any interference in the operational freedom to handle scientific problems as I liked to. This is what I would consider intellectual autonomy. Autonomy particularly in the mission-oriented institutes has to be viewed in the context of the objective of the institutes and the country's needs. It also does not mean that he is free from accountability for the financial and other resources placed at his disposal. On the contrary, scientists should be paradigms of discipline and accountability for the financial and other resources placed at his disposal. Administrative rules, regulations and procedures are man-made and can be changed: genuine difficulties in the way of

pursuit of scientific research should be removed. So long as finances are derived from public funds, the scientist is as responsible as any one else spending public funds to account for them.

The problem of autonomy has a twin brother, i.e., the hierarchy. Here again, I think, there is considerable misunderstanding. Science recognises no intellectual hierarchy. Wherever it exists it must be completely inhumed. But in a research laboratory where a few hundred scientists make the staff, there will be a sort of disorder if all of them begin to feel that they are not answerable to anyone. In such a situation, indiscipline and irresponsibility would breed. Have we taken care that this does not arise ?

## THE NEED FOR HEALTHY ATTITUDES — ROLE OF SCIENTIFIC SOCIETIES

The emergence and development of scientific organisations on a large scale in the wake of independence have also widened the scope of and opportunities for scientific careers. A number of problems have arisen the most noteworthy of which is the growth of careerism in Science. From savants scientists have now become "scientific personnel". Before independence, only those interested in scientific work took to it; a few made a comfortable living out of it, but, by and large, scientific career did not offer much in terms of money and material acquisitions. But, science now offers a career and social position too.

Careerism in Science brings mixed results. On the one hand scientists as a group have developed greater social awareness. On the other Science-for-career attitude is apt to make a scientist emotional or subjective in his approach to scientific work and life. Quite a few scientists nuture the feeling that the very fact of their being scientists entitles them to special rights and privileges in society. A new class-consciousness reminiscent of the privileged priestly class of medieval India is discernible. One viewpoint is that because Science helps improve material life, it is loftier than other forms of knowledge. Nothing can be more erroneous than the belief that a particular kind of knowledge is superior to others. Knowledge is varied and integral to progress. A balanced blend of human talents is what ultimately makes a healthy society. Unless scientists are tempered with humility and with the knowledge that they are but one of the many who contribute to the growth of society, they are likely to fail to make an impact on society and earn its confidence.

Learned societies and professional bodies should provide leadership to the scientific community and create and mould public opinion by example and precept. With such a lead, possibilities of unhealthy tendencies in the body politic of Indian Science can be curbed or at least contained. With diversification and growth of Indian scientific institutions, there is a growing number of young men and women engaged in scientific careers. They are easily susceptible to influence due partly to economic reasons and partly to the lack of proper understanding and appreciation of the true role of Science. They are likely to become easy victims of shibboleths and slogans and their careeristic attitude may sometimes lead them into wrong thinking and action. The spectacle of a large body of such talented people adrift should be a matter of concern. I appeal to the learned societies to give serious consideration to this problem. Societies should provide leadership to the large body of impressionable young minds.

The Government has a vital stake in this matter. It should encourage scientific societies and consult them on matters of moment. The Government of India has long been thinking of setting up a single national academy of Science for the country. I might mention that as early as 1945, the Government had declared the National Institute of Sciences of India as the premier scientific society in the country. There are well-organised professional societies in most branches of Science and

technology whom the Government could call upon for advice. What is needed is for the Government to cultivate the habit of consulting such societies.

**SCIENCE AND SOCIAL FORCES**

Another important duty of the learned societies is to bring about greater understanding between scientists and society. The scientific point of view alone can neither explain nor deal with the dynamics of society. Such a view would presume social forces to be simple, which they are not. Even in highly developed industrialised societies based on Science and technology complex social forces are at work. Some intellectuals feel that a deep cultural crisis has overtaken humanity and that individual freedom and human dignity are at stake. Others stress the need to re-establish spiritual values. While scientists may claim to be the new humanists, there are others who feel that the changes brought about by the scientific orientation of life and the industrialisation of societies are not all for the good.

Science and technology are only a part, though an important part, of a complex set of forces moulding society. While Science and technology should become an essential and integral part of our culture, we cannot ignore other aspects. It is naive to assume that because it contributes a great deal to material well-being and physical comfort, scientific and technological progress automatically results in human progress. Behavioural Sciences as applied to human and social functioning are still in their early stages of development. Perhaps, with the development of these Sciences, we may have a deeper understanding of the individual and society. I am no expert in social Science. The point I wish to make is than an industrialised society based on Science and technology is not an unmixed blessing. For, how else can the mental stresses, strains and ailments caused by them in highly industrialised western societies be explained ?

The limitations of Science are better appreciated today than ever before. Seemingly, great truths of Science pale off both at the macrocosmic and microcosmic levels. The principle of uncertainty shows that Science is confined to the limits of observation. Relativity, on the other hand, has established that what a scientist deals with are not actual events but observations of the events and, thus, is subjective. The philosophical import of these two discoveries has been stupendous both on scientific and non-scientific thought. The true scientist is humble enough to realise this situation.

Acharya Vinoba has been saying that Science and spirituality have taken the place of politics and religion in the modern world. It is a profound statement. Nehru saw its implications in a society such as ours. One often hears it expressed as the viewpoint of scientists and also the scientific viewpoint that religion has acted as a drag on the advancement of the country ; it is also said that religion in Indian society has acted as a counterweight against rationalism, as a force against the spirit of Science. It is advocated by some that unless religion is relegated we are not likely to make much progress.

When we refer to religion, what do we have in mind — dogmas or spirituality ? If by religion we mean dogmas, superstitious and obscurantism, we should shed it off most determinedly. The Indian mind has the subtlety to distinguish between spirituality and religion. Some spiritual content in human life is essential for its sustenance. The basic irrational forces at work in man and society cannot be easily explained. Sigmund Freud proved in a systematic manner how profoundly irrational forces and hidden motives shape human behaviour. These forces should not be allowed to take better of us humans but should be reined in and channelised. Perhaps, religion has been aiding man to achieve this essential task. It has also satisfied the urge in man for social cohesion. Science is yet to prove its value as a cohesive force in society. Spirituality

perhaps has a greater potential in this regard. Science has not discovered a chemotherapeutic agent which can induce virtues in man nor has it produced an antibiotic which can fight bigotry. Religion without the temper of Science is superstitious. Science untempered by spirituality can be dangerous.

Human society is basically conservative — slow to change and evolve. Science, on the other hand, is basically revolutionary and upsets *status quo* by making unknown known. Modern technology which is continuously changing the material and social conditions of man intensifies the challenge of Science to society. Older the society the more conservative it tends to be. Ours is a society with centuries of history behind it and so are our people steeped in tradition. In dealing with the problems of an ancient society such as ours we come across innumerable difficulties. But our approach to the problems should be pragmatic. Let us avoid the futile exercise of finding faults. Instead, we should demonstrate by constructive endeavours the positive benefits of Science and technology. The vast masses of our people take succour in fatalistic beliefs, and religion appeals to them for the promised better things in the next life. Mahatma Gandhi used to say, "To the poor, God can only appear as bread or a bowl of rice". Before we expect people to break away from traditions and develop a scientific attitude, we might as well ask ourselves, whether we have provided them even the elementary benefits of Science — food, shelter and clothing; in short, economic security. Instead of giving our people more Science and the accruing material benefits, are we justified in giving them ideology and the conflicts attendant to it ?

**SOME PROBLEMS OF SCIENTIFIC TALENT AND MANPOWER**

We frequently hear of our difficult manpower position, particularly about the shortage of able people and the problem cryptically described as "brain drain". It may be conceded that there is a shortage of able people. This bad situation is made worse due to two reasons. One's reputation, prestige and influence are determined by one's ability to move in the right circles and to have the right contacts. It is often difficult to withstand temptations and stay on in a laboratory to struggle with one's problems. The lure of opportunities does not always have healthy influence. The size of our country adds to the difficulty. It is not easy to know all the talented individuals spread over 70 universities and nearly two hundred scientific and academic institutions scattered over an area of above three million square kilometres. This results in two consequences. The few who are identified are sought after again and again. They soon lose their bearings in the area of Science which once was their forte. As a result, a few individuals tend to feel disproportionate importance in the community and develop tendencies akin to "mathad-hipatis". Others, many of them young, remain unrecognised. Since they are unable to enjoy the opportunities that frequent the fortunate few, they become disenchanted, critical and even cynical. Often this cleavage assumes the controversial tinge of young versus old. In absolute terms, I do not think the nation is short of talent. Rather, the fault seems to lie, first in the defective methods of locating talent and, secondly, in the overuse and diffusion of talent. Government's method of consultation should not unduly distract scientists from creative pursuits, nor should they be neglected.

Another related topic which comes to my mind links creativity with age. In absolute terms, creativity has little to do with age. Relatively speaking, however, at young age, the propensity to discovery is sharper. This is a statistical statement. Because the young mind is not loaded with knowledge and its sense of wonder is still keen, it proceeds unfettered by preconceived ideas. It is able to hazard hypotheses which may seem too bizarre to minds saddled heavily with preconceptions. Such strides of the young mind sometimes make significant discoveries. This theory

is not peculiar to Science alone. William Wordsworth seemed to feel that infants had spiritual knowledge and the shades of the prison house close upon the growing mind. When a young scientist makes a significant discovery, he becomes a celebrity and has to give of his time receiving awards, addressing meetings, discussing in committees and so on. Circumstances tear him away from creative scientific work. He may yet obtain plenty of equipment and money, acquire status and security but he does not have the time or the moorings for creative work anymore. May be, in this manner, we might have lost quite a few who might have blossomed to distinction.

The essentially statistical theory of creativity and age is often strained to extreme lengths. The theory bears relevance to discoveries and may, therefore, be applicable in the Pure Sciences. It is not of much value in the application of knowledge as in technology, engineering, industry, agriculture and medicine. In these spheres accumulated knowledge and experience weigh much. Competence is and should be the only test in any area of human endeavour.

While every one should warmly endorse the view that the young should be encouraged, the temptation to make another generalisation should be resisted. If one studies the lives of eminent Indian men of Science, who may now be put in the category of the old, one will notice that most of them achieved distinctions while they were young. One might recall that during early days heads of several national laboratories were appointed in their thirties and forties. Old order changing and yielding place to new is but a natural process. The process thus goes on and will continue to operate for all times to come. Does this process which is obvious and inevitable really need a push? Although it is often said that the young are exploited by the old, I have yet to come across a single case of anybody being penalised for this. Specific cases of exploitation should be identified and the wrong doer dealt with. It is most important to remember that in our enthusiasm to encourage the talented, we should not support mediocrity in the name of young.

Much is being said and written about "brain drain". There have been discussions on this problem all over the world. Many have described the phenomenon just as it has appeared to them, they have diagnosed the causes for what they consider a disease and have suggested various remedies. I have also made a little contribution to this discussion and quite a few interpretations to what I said have been tossed about. I must confess that some of these interpretations have amazed me. For some people have even gone to the extent of saying that I was closing down the Scientists' Pool. I must emphatically say that this is totally incorrect.

The problem of brain drain is not peculiar to India. No country in the world except perhaps the United States is free from it. In the so-called "brain drain", the treak seems to be towards the United States. To some extent, the other developed countries in Europe serve as an interface between the developing countries of Asia and Africa and the United States; but the ultimate receiver is the United States.

I would like to deal mainly with two facts of the problem. The first is the fact of migration. Since the last world war, mobility of scientists and other skilled persons has considerably increased throughout the world. Apart from the fact that the language of Science and technology is universal, the increasing use of English as the common medium of communication among scientists and technologists has made mobility easier. Skills always seek opportunities and the United States provides today those opportunities which give satisfaction, both ephemeral and real. It is difficult to stem the flow of scientists, but we should take more steps to lessen the number to ensure that it

does not work to our disadvantage. But for the measures taken in this country to induce scientists to return or stay at home the outflow of scientific talent from India would have been much greater.

The second aspect of this problem is what precisely can be done to get the foreign-based Indian scientists and other qualified persons back to our country. Here again, we tend to become emotional and subjective in our approach and even forget those who are already in the country. Are we doing enough to recognise and satisfy the competent and the good who have chosen to stay home? A general call for return of scientists abroad is no remedy. The Scientists' Pool, the creation of supernumerary posts in Government establishments and other palliatives barely touch the fringe of the problem. Unless the growth of our economy is such that it can absorb them fruitfully, the return of a large number of skilled and qualified men and women will only add to the prevalent atmosphere of frustration and resentment in our intellectual life. Those who can be absorbed in the growing economy should be encouraged to come back. They would find satisfaction for themselves and give satisfaction to the nation. Any other step unrelated to the needs of the country will not help, it may only worsen a problem already bad enough. Ultimately, the real solution lies in the economic growth of the country, on the basis of which industry will develop and wealth produced. This is turn would sustain the creation and growth of social institutions and generate multifarious other activities needing the services of qualified men of various types. The point becomes clearer by the fact that it is becoming increasingly difficult to provide employment even to engineering graduates. With the relatively meek economic growth compared to our progress in education, the exodus of scientifically and technically qualified young persons may increase. Most of them are patriots but we cannot expect them to live by patriotism alone.

## THE PROBLEM OF KNOW-HOW AND FOREIGN COLLABORATION

Foreign collaboration and import of "know-how" is another subject on which strong views are often expressed. Whatever may be the views of scientists and technologists, let us not make any mistake about the general psychology influencing the policy of foreign collaboration and technical "know-how". Since 1947, our country has registered a fairly good economic growth. By and large the growth is based on foreign collaboration and imported "know-how".

The government has adopted a fairly liberal policy towards foreign investment and remittance and repatriation by foreign investors. There is a feeling that foreign collaboration has been permitted even where "know-how" was available in the country. Some say that laboratory scale operations are mistaken for technical "know-how". An investor invests for profit. Altruistic motives play little part in this matter. Unless we are able to give the investor the whole "package offer" consisting of technical and economic "know-how", plant and machinery, managerial and marketing techniques, technical "know-how" alone will not interest him. The research scientist cannot offer the whole gamut of expertise and "know-how" to make an industrial enterprise. No where is it so. Lack of appreciation of the role of the research scientist can cause much wastage of time effort and unnecessary recrimination.

Industrialisation in the modern sense has brought with it new techniques of management of high sophistication. Such responsibilities as the following, which now devolve upon large industrial management, were mostly unknown before:

1. choice of product;
2. design of operation for production;
3. securing and using the necessary materials, machines, power and labour;

4. merchandising and marketing of the products;
5. financing the operations; and
6. building and maintaining a large network of functional set up.

All this requires management skills with quite involved and complex procedures. If we are to be in the forefront of the industrial and commercial world, trade with other countries and keep our balance of payment position sound, we need all these skills. An institutional structure for fostering such activities and working in close integration with research institutions is the crying need of the hour.

There is also the psychological aspect of the widespread felling prevailing in the country that anything foreign is superior to anything Indian, which pervades even our intellectual life. It is also discernible in our Science and technology. In industry, nothing ensures the success of a product better than a foreign name tagged to it or its association with a foreign firm. Gone are the days of Swadeshi spirit. It may need a Gandhi to propagate a new wave of confidence in our efforts and in our achievements.

While we should develop confidence in our own efforts, we should not in the name of "Swadeshi" re-invent what is known, unless we are denied the use of technology available abroad. When technology can be purchased from others without compromising national interests and crippling local efforts, we need not take a doctrinaire view of things. It may be asked if technology can be purchased from others, where do Indian scientists come in? It is well-known, that even where technology may be available from outside, large amount of work has to be done to adapt it to local needs and conditions. Therefore, in developing countries high priority must be given to adaptation work. Technological independence, though a desirable goal, is not easy to achieve. Not even the USA, which is perhaps the only country which has a positive balance of technological payment is technologically independent. She pays about 70 million dollars per year to others. We should develop technological competence rather than strive after technological independence.

**SCIENCE, GOVERNMENT AND POLITICS**

The prosperity and security of nations are determined largely by their scientific capability and industrial strength; hence, the tremendous growth of patronage of government extended to Science and the spectacular outlay which governments make on scientific progress. Scientific activity is assuming an increasely important part in the functions of our government. This is bound to grow further.

The place of the scientist in government is now taken for granted and to some extent he participates in decision-making and discharging executive functions. This situation is not without its side-effects. The possibility exists of individuals assuming roles far beyond their competence or their jurisdication. Such instances are not wanting. I think two safeguards must be ensured. One is, the right man must be in the right place. The other is that the machinery of consultation should be such that no single individual should be privileged to give advice and take decisions of importance merely by virtue of his position. There is, therefore, a good case for making consultation by government more effective by widening its scope through scientific societies.

Science places immense power in the hands of the State. Scientists are the instruments for wielding this power. This throws scientists into the arena of politics. The example of Lord Cherwell and several others illustrates this. The scientist today finds immense scope and opportunities to assume overlordship over considerable areas of governmental activity. This is a matter which needs the attention of the scientific community, and measures should be evolved to ensure that ultimately

tendencies do not overwhelm scientists. Unless the scientific community is alert, its very integrity may be put in jeopardy.

In a parliamentary democracy where development of Science is a cardinal principle of State policy, it is but natural that parliamentarians should get increasingly involved in affairs of Science. It is a matter of gratification that we have an Indian Parliamentary and scientific Committee consisting of Members of Parliament and representatives of scientific institutions. It is desirable that parliamentarians and scientists should come in close contact so that the former may also appreciate the methods of Science and their application for the welfare of the country. To enable parliamentarians to obtain authentic, objective and up-to-date information on scientific matters, it will be useful if a Scientific Information Unit is established in the Parliament Secretariat.

By virtue of the power and influence scientists command today, they have attained a high place in political decision-making. In certain matters they play the crucial role in the West. It will not be long before the scientists will be called upon to assume such roles in this country also. The fact that Science is universal in character and does not recognise national boundaries makes it an important vehicle for fostering international understanding. In matters connected with modern defence and armament policy and in similar other issues scientists have come to occupy a special and significant position. In a world becoming increasingly dependent on Science and technology, scientists must clearly undertstand their responsibilities. I am not stating that scientists should go into politics. The point I wish to make is that problems in the modern world cannot and should not be left to the politicians alone. Scientists and technologies have a vital and active role to play and are not merely to act as advisers.

Ladies and Gentlemen : I have covered rather a wide canvas. I have deliberately raised some questions not so much with a view to offering immediate solutions but with the intention of evoking the interest of the scientific community in these matters and provoking discussion thereon. It is desirable that members of the scientific community should interest themselves in problems around them and bring to bear upon them the scientific aproach. Likewise they should shape their own attitudes to their scientific work, society and other fields of knowledge so that they view these problems in a proper perspective. Issues unrelated to Science should be kept off discussion. The quality of scientific approach endows scientists with the ability to think and act objectively and we should preserve this quality at all costs. The need for creating a healthy scientific public opinion in this country is greater today than ever before. Far too much of scientific matters is conditioned by official dom. In a democracy, people mould government policies; unless the scientific community in the country is able to shape and influence government policies through healthy, objective and strong public opinion, Indian Science may suffer. Scientists should be aware of the snaring charms of "organisation". Just as Science is no magic wand, so also is organisation which too cannot perform miracles. I cannot refrain myself from making an earnest appeal, particularly to young men and women, that they should not fall a prey to cliches and catch phrases. There is no substitute for hard and devoted work. We should develop the will to work hard; for nothing but diligence and dedication can bring rewards commensurate with the aspirations of the young minds.

# ULTRASONIC TECHNOLOGY FOR FOOD INDUSTRY

Krishna Murti Raju, Ritesh Prajapati and Rudra Kant Srivastava*

**Ultrasound has been used for processing purposes in industries and now it is emerging as a perspective technology in different segments of food industries. This potential technology is gaining rapid momentum in food processing organization. Earlier, ultrasonics was used for cleaning purposes in food sectors. The range extends from the cleaning of nozzles used in breweries to the cleaning of bread pans in bakeries. Besides cleaning, it has also proved its significance and potential for the extraction of juice, concentration of thixotropic composition, homogenization and emulsification, improving crystallization rate and drying. This broad spectrum of application can safeguard its use as a valuable technology in the 21st century.**

## INTRODUCTION

Ultrasonics as a technology can probably be said to have valuable position from its birth during World War I in a laboratory in Toulon (France) when Prof. P. Langevin designed and built a high power ultrasonic generator which used quartz crystals as active elements. Today, the number of ultrasonic processing devices in commercial use is in lacs. The two main mode of ultrasonic production are the piezoelectric effect and the magnetostriction effect. By the piezoelectric effect, we can produce ultrasonic frequency around 540 kHz by quartz crystal and around 1.5 MHz by tourmaline crystal. By using Magnetostriction effect, we can produce ultrasonic waves of frequency 8-20 kHz for nickel tube and can be extended from few hundreds to 300 kHz changing dimensions and mode of vibrations.

The application of ultrasound within the food industry has been a subject of research and development for many years. Many laboratory studies of the potential applications of this energy have been performed; however, little of this work has been reported in depth. The sound wave in which, the frequency is above the limit of human audibility i.e. greater than 20 kHz referred to as an ultrasonic wave. The upper frequency limit is indefinite since it is continuously increasing as new techniques are discovered. It is now 10 GHz in laboratory applications. The reason why frequencies above, rather than below, the audible range are used is that the people who have to be in the vicinity of the equipment are more comfortable because there is less noise. Another reason is that many processing applications require high acceleration and it is easier to get this high acceleration by high frequencies. Ultrasonic vibrations can be produced in any sort of materials-gaseous, liquid or solid. It is important to realize that the passage of sound wave through some materials does not produce any net displacement of the material around their equilibrium position[1-2].

## APPLICATION OF ULTRASOUND IN FOOD INDUSTRY

In 1920, it was reported that the bacterial effect in foods can be reduced using ultrasound. As a general rule, small microorganisms are less easily

* Department of Physics, Bipin Bihari P.G. College, Jhansi-284 001, Uttar Pradesh.

damaged than larger one. At low intensity, the tendency is for growth to be stimulated because individual member of a colony is dispersed. If ultrasonic power is increased at a certain threshold; destruction of microorganisms sets in and with further increase, the rate of destruction increases. The bactericidal effect is reduced due to mechanical disruption of cells by very intense currents generated within the media by ultrasound. The main lethal effect is due to cavitation. Highly reactive chemical radicals and reaction product e.g. $H_2O_2$ of well known lethal capacity are liberated in the aqueous media during cavitations. Also there is extreme pressure variation caused by implosion which generates very high temperature. It has been observed that microorganisms can withstand high pressures but they are incapable of withstanding the quick alternating pressures produced during cavitation. Presently, some problems are still to be cleared and explored but it is definitely and reasonable to presume that ultrasound could be applied to the pasteurization or sterilization of fruit juices, milk or other liquid products within the next twenty years. Other applications may also include its minor use in 'fobbing' of carbonated beverages, particularly, beer. In the production of bottled beer, it is important to remove all air from the bottle above the beer surface. If this is not done, then some bacteria present in air can produce certain reactions that will give taste to the beer. The use of ultrasound in the plastic packaging of foods where plastic welding is necessary for sealing has been reported[1]. Ultrasonic plastic welding of containers is excellent for heat sensitive foods, since the heat for welding occurs only into the food being packaged. The applications of ultrasound in food industries are summarized as follows[3-5]:

## CONCENTRATION OF THIXOTROPIC COMPOSITION

Recently[6] a process has been developed to preserve the citrus fruit juice. Using high frequency vibrations, the likelihood of impairment of flavour is minimized. This process is carried with continuous recycling of the product withdrawn from the evaporator back through the ultrasonic treatment unit into the evaporator. In this manner the concentration is increased gradually up to the desired level. Fruit juice of a concentration of 75° to 85° Brix can be prepared. The preparation of juices of purees of such a high concentration is very desirable since at this level of concentration no special measure for preservation such as pasteurization or freezing have to be taken. All that is required with such a product is stored under refrigeration so as to prevent non-enzymatic browning. Such a degree of concentration could not be achieved even with modern evaporators containing heat exchangers designed to cause high turbulence of the concentrate. The highly concentrated juices obtained by this process are considerably less viscous than would be the case if concentration of the same degree were prepared.

## HOMOGENIZATION AND EMULSIFICATION

A treatment of a two-phase liquid system by ultrasonic cavitation can be readily accomplished either on a continuous basis in a tank. The mechanism that is effective in homogenization and dispersion is the extremely high instantaneous localized pressure pulse that results from the cavitations process. They propel minute droplets of one phase into the region of other. The droplets are very small hence they are more apt to be stable. In a system consisting of two immiscible liquids if cavitations occur at the interface between the liquids, one phase become dispersed in the other. The emulsions are often more stable than those produced conventionally and generally require little, if any, surfactant. The applications for ultrasonic homogenizers in the food industry include the manufacture of salad creams, ice-cream mixes, cream soups, essential oil emulsions, covertures chocolate, artificial creams, baby foods, beverage emulsions, beverage flavours, chocolate syrup, chocolate drinks, condensed milk, ice cream etc.

**CONCENTRATION BY CRYSTALLIZATION**

Ultrasound ranging from 20 kHz to 100 kHz is extremely useful in crystallization processes. It serves a number of roles in initiation of seeding and subsequent crystal formation and growth. New researches[5-7] have reported a method for concentrating an aqueous solution by crystallization where by the aqueous solution is contacted with carbon dioxide to form a slurry of ice crystals in mother liquid and the slurry is passed to a crystal growth zone. The process using beer as the representative aqueous solution can be cited as an example.

**EXTRACTION OF JUICE**

The mechanical effect of ultrasound provides two major benefits which increases the extraction rates :

(i) Improved mass transfer to and from interfaces

(ii) The disruption of biological cell walls on the surface and within the plant material to facilitate the release of contents.

A mechanical orbital mass type of sound wave generator is used which produces sonic waves of relatively low frequencies as compared with the audible spectrum typically from hundred Hz to an order of 20 kHz. The process is mainly used for fruits and vegetables. The vegetable or sugarcane is first chopped up into fairly small pieces. The chopped material is then placed in a treatment chamber and covered with a small quantity of liquid such as water to serve as an acoustic coupling medium within the treatment chamber, the one wall is sound wave radiating surface. The sound wave is transmitted viz. liquid to and through the pieces of vegetable substance or sugarcane. The sonic wave energy has an action on the vegetable substance, which results in a differential vibration of the fibre and juice. Due to difference in densities, elasticity and frictional resistance, the acoustic impedance of fibres and juice is different in magnitude and phase angle. Thus fibres and juice substances must vibrate at different amplitude and in different time phase in response to transmission of sonic waves. Also, sound wave transmission results in the juice and fibres ingredients vibrating with different accelerations and to different maximum velocities. Further, the velocity of sound in fibres differs from that in the juice[8].

**DRYING**

Acoustic drying is of potentially great commercial importance. Sonically enhanced drying can be carried out at lower temperatures than by conventional methods, which reduces the probability of oxidation or degradation in the material. The high particle velocity that exists in a sound wave can be used to promote drying of various materials in powder, sheet and fibre form. This is also an extraction process and involves the change of moisture concentration gradient near the surface of the material being dried. The gradient is modified by the vigorous agitation of the air by sound wave. This method of drying has an advantage in the case of heat sensitive material and where high velocity steady air current might blow away or damage the product. Another reason is that it can penetrate around and behind particle and reshape by echoing.

**CLEANING**

An application of ultrasonics outstandingly successful is in cleaning processes. This has been proved to be more efficient technology than any other conventional method. Ultrasound is particularly useful in surface decontamination where in the rush of fluid, which accompanies the collapse of cavities near a surface. With proper solvent, wetting agent and proper temperature, the efficiency can be increased. The task is simpler if the contaminant is brittle. Viscous insoluble films that wet the surface are somewhat difficult to remove. Root vegetables can be ultrasonically cleaned although the continuous removal of dirt from the cleaning solution and pre-washing is usually desirable. Dirt trapped in holes or crevices is rapidly

removed. It also extends from the cleaning of nozzles used in breweries to the cleaning of bread pans in bakeries. It is perhaps interesting to note that ultrasonic cleaning used in bakery is the only effective technique. Any spongy bread or cakes tends to absorb sound and prevents cavitations, therefore, the soft material must be removed first by soaking and brushing[4].

## SAFETY PROBLEMS

The effect of ultrasound on the operator is a major concern. The ill effects that may result from the operation of ultrasonic equipment might be hearing loss and other physiological effects such as: fatigue, nausea and pain etc., due to air borne noise radiated by equipments and the local damage resulting from direct contact with an ultrasonically vibrating device. The following safeguard can be taken against unnecessary exposure to air born noise from ultrasonic equipment while locating the equipment in an area where personnel who are not working with the equipment do not construct an enclosure around the equipment leaving one side open, if necessary, compel workers who are in high noise region; to wear devices to keep an excessive amount of sound away from reaching their ear and making no contact of any part of the body with any ultrasonically vibrating device. Though, there has been no proven medical evidence that industrial ultrasound has had any effect on the operators of equipment and use of ultrasound in food industry has not proved to be dangerous in any way.

## CONCLUDING REMARKS

The growth of ultrasonics is following a natural pattern for any fledging field[9-10]. Initially, ultrasonics was found to be extremely efficient for the production of an oil and water emulsion. Its applications have broadened considerably and now it is believed that ultrasonics is set to make a considerable impact on the food industry over the next decade. Several factors viz. new materials which can reduce the cost of ultrasonic equipment, methods for producing vibrations of sufficient intensity and consequently, more powerful sources of vibrations, improvement in basic designing and finally the availability of trained personnel, have to be explored in depth to make the application of ultrasonic more meaningful and significant in food industries.

## REFERENCES


1. K. M. Raju, *IAPT Bulletin*, **3,** (72), 2011.
2. Leif Bjorno, *Physics Procedia,* **3**, (5), 2010.
3. J. Benedito, J. V. G. Perez, M. C. Dobarganes and A. Mulet, *Food Reasearch Inter*., **40**, 406, 2007.
4. Ultrasonic Cleaning, ASM Handbook of Surface Engineering, ASM International, Materials Park, **5,** (44), 1994.
5. J. D. Heffington, J. P. Chambers and B. Goodwiller, Meeting Proceedings, 6th Meeting of the MidSouth ASA Chapter, Arkansas, 2010.
6. M. J. W. Povey and T. J. Mason (Eds.), Ultrasound : A new opportunity for food preservation, 1998, Blackie Publication, New York.
7. P. Shallenbergar, Encyclopedia of Nutrition, Food Science and Food Technology, 1993.
8. J. K. Paul, Fruit and Vegetable Juice Processing, Noyes Data Corporation, New Jersey, 1975.
9. Kailash and K. M. Raju, *Everyman's Science*, ***XLI***, 52, 2006.
10. K. M. Raju, *IAPT Bulletin*, **24,** (285), 2007.

# SWINE INFLUENZA – A GLOBAL THREAT

S Parthiban* and H. K. Mukhopadhyay

**This article gives an insight to the probable source of origin, evolutionary progress, the current scenario and the possible measures that may be explored to further strengthen the war against pandemic swine influenza. The ability of viruses to adapt themselves to the changing environment has made it possible to inhabit itself in this vast world for the past millions of years. Current infections were found to be caused by a new strain of influenza type A H1N1 virus which is a re-assortment of several strains of influenza viruses commonly infecting human, avian, and swine population. Pigs have receptors to both avian and human influenza virus strains. Consequently, they have been considered a possible "mixing vessel" in which genetic can be exchanged, with the potential to result in novel progeny viruses to which humans are immunologically naive and highly susceptible.**

Swine influenza is a contagious respiratory disease that normally only affects pigs. Swine influenza viruses are influenza A viruses, and classified into subtypes based on two surface antigens, the hemagglutinin (H) and neuraminidase (N) proteins. These two proteins are involved in cell attachment and release from cells, and are also major targets for the immune response. There are several subtypes and variants of these viruses which are circulating in pigs throughout the world. Currently, the most common subtypes are H1N1, H1N2 and H3N2. Swine influenza viruses cause acute respiratory disease in pigs. Complications may include secondary bacterial or viral infections. Although the morbidity rate is high, the case fatality rate usually varies from less than 1% to 4% in uncomplicated infections. Human infections with swine influenza viruses are occasionally reported, and may resemble human influenza. In April 2009, a novel H1N1 virus began circulating in people. The genetic analysis of this virus suggests that it originated from one or more swine influenza viruses. Pigs are susceptible to the novel H1N1 virus, and precautions should be taken to prevent infection of swine herds. One herd in Canada was apparently infected via contact with an infected person.

10/442, 1st Cross, Thulukathamman Nagar, Murungapakkam Post, Pondicherry-605 004. Email : parthis17@gmail.com

## EVOLUTION OF NOVEL H1N1 STRAINS

Influenza A viruses change frequently. Strains evolve as they accumulate point mutations during virus replication; this process is sometimes called 'antigenic drift'. A more abrupt change can occur during genetic reassortment. Reassortment is possible whenever two different influenza viruses infect a cell simultaneously; when the new viruses (the 'progeny') are assembled, they may contain some genes from one parent virus and some genes from the other. Reassortment between different strains results in the periodic emergence of novel strains. Reassortment between subtypes can result in the emergence of a new subtype. Swine influenza viruses can recombine with human or avian influenza viruses, and probably with influenza viruses from other species. This type of reassortment can result in a 'hybrid' virus .An abrupt change in

the subtypes found in a host species is called an 'antigenic shift.' Antigenic shifts can result from three mechanisms : (1) genetic reassortment between subtypes, (2) the direct transfer of a whole virus from one host species into another, or (3) the re-emergence of a virus that was found previously in a species.

Swine influenza viruses are occasionally found in other species including humans. In most cases, people are infected by direct contact with swine, and the virus, which is poorly adapted to humans, is transmitted to only a few people before disappearing. In 2009, a novel H1N1 virus has emerged in humans and is being transmitted from person to person. The genetic analysis of this virus suggests it originated from one or more swine influenza viruses. Although the subtype is H1N1, this virus is not one of the H1N1 viruses that normally circulates in pigs in either the Eastern or Western hemispheres; instead, it appears to be a reassortant between a "North American virus and an Eurasian virus. In two isolates from human cases in California, the novel H1N1 virus contained a hemagglutinin gene that is most closely related to swine influenza viruses in "North America, a neuraminidase gene that is related to swine influenza viruses in Eurasia, and internal genes from both viruses.

**TRANSMISSION**

In mammals, influenza viruses are transmitted in aerosols created by coughing and sneezing, and by contact with nasal discharges, either directly or on fomites. Close contact and closed environments favor transmission. Mammalian influenza viruses are relatively labile, but can persist for several hours in dried mucus[4-5] Swine influenza viruses are inactivated in untreated pig slurry in 1-2.5 hours at 50-55°C, two weeks at 20°C, and 9 weeks at 5°C. Ordinarily, swine influenza viruses circulate only among pigs, equine influenza viruses among the Equidae, avian influenza viruses among birds, and human influenza viruses among humans. Occasionally, these viruses cross species barriers. Recent serologic evidence suggests that swine influenza infections may occur regularly in people who have contact with pigs. Pigs are readily infected with human influenza A viruses, but most strains do not spread widely. Rarely, transmission between species results in an epidemic in the new host. Generally, this requires a novel hemagglutinin and/or neuraminidase protein to evade the immune response, together with viral proteins that are well adapted to the new host's cells. In 2009, sustained transmission of a novel H1N1 virus with genes of swine origin has been reported in human populations.

**DESTRUCTION OF VIRUS**

Influenza viruses are susceptible to many common disinfectants including sodium hypochlorite, 70% ethanol, oxidizing agents, quaternary ammonium compounds, aldehydes (formalin, glutaraldehyde, and formaldehyde), phenols, acids, povidone-iodine and lipid solvents. They can also be inactivated by heat of 56°C (133° F) for a minimum of 60 minutes (or higher temperatures for shorter periods), as well as by ionizing radiation or low pH (pH 2). For disinfection of the swine origin H1N1 virus in laboratories, the CDC recommends 70% ethanol, 5% Lysol®, or 10% bleach.

**INFECTIONS IN HUMANS**

Influenza infections generally become apparent within a few days of exposure in all mammals. The incubation period for the novel H1N1 virus circulating in humans appears to be 2 to 7 days. Human infections with swine influenza viruses have been recognized for decades. Serologic evidence suggests that these infections may be relatively common among people who are occupationally exposed to pigs. Some viruses found in people are common strains that circulate in swine, but novel viruses apparently generated by the reassortment of two swine viruses have also been described. Reported cases of swine influenza include the following:

A self-limiting illness with flu symptoms was reported in a college student. There was evidence that his room mate had been infected but remained asymptomatic. An infection with flu symptoms including diarrhoea was reported in a young boy, who recovered. There was no evidence of spread to his family. Swine influenza virus was isolated from an immunocompromised child with pneumonia who died. Serologic evidence of possible infection was found in five contacts, but the infection did not spread further. In 2009, a novel H1N1 virus with genes of swine origin began infecting people. Infections in humans appear to resemble human influenza, and may include fever, chills, cough, sore throat, rhinorrhea, headache and myalgia. Vomiting and diarrhoea have also been reported in some cases. In Mexico, some patients have developed rapidly progressive pneumonia and acute respiratory distress syndrome; some cases have been characterized by respiratory failure severe enough to require mechanical ventilation.

**COMMUNICABILITY**

Person-to-person transmission occurs with the H1N1 virus that is currently circulating in humans. For this virus, the estimated period of communicability is from 1 day before the symptoms appear, to as long as 7 days after their onset. Children, who can shed human influenza viruses for at least 10 days after the onset of disease, should be considered infectious for this long. It is possible that people may shed the virus for as long as they are ill.

**DIAGNOSTIC TESTS**

Diagnostic laboratory workers should work with clinical samples from suspected swine influenza cases in a BSL2 laboratory, and a biosafety cabinet should be used for all sample manipulations. Virus isolation should be carried out under enhanced BSL2 conditions (BSL3 practices in a BSL2 laboratory). Influenza A infections can be diagnosed by virus isolation. These viruses can be isolated in cell lines or chicken embryos, and are identified by hemagglutination inhibition tests. The hemagglutination inhibition test, which is subtype specific, is most often used. Nucleic acids can be detected in respiratory secretions by Reverse Transcriptase Polymerase Chain Reaction (RT PCR) assays, and antigens can be detected in respiratory secretions by immunofluorescence or Enzyme-Linked Immunosorbent Assays (ELISAs). Infections can also be diagnosed retrospectively by serology with a fourfold rise in titer.

**TREATMENT**

Supportive care for swine influenza in human includes fluids and rest, as with human influenza. Outside Mexico, most patients infected with the 2009 H1N1 virus have had relatively mild disease and have usually recovered without treatment. However, severe cases are also expected to occur. Four antiviral drugs are available for influenza treatment in the U.S. Amantadine and Rimantadine (adamantanes), as well as Zanamivir and Oseltamivir, are active against some influenza A viruses, if treatment is begun within the first 48 hours. When used against human influenza viruses, treatment usually results in milder symptoms and recovery, on average, one day sooner. Side effects, including neuropsychiatric events, may occur. Drug resistance develops rapidly in human influenza viruses exposed to Amantadine and Rimantadine, and may emerge during treatment. Testing must be done to determine each swine influenza virus's susceptibility to antiviral drugs. The novel H1N1 viruses circulating among humans in 2009 appear to be sensitive to Oseltamivir and Zanamivir, but resistant to Amantadine and Rimantadine. The CDC has issued interim guidance for the use of antiviral drugs in treatment and prevention. Although these drugs work best if begun during the first two days of illness, they may also be used later in some cases.

**PREVENTION**

Preventing infection with swine influenza viruses normally found in pigs. Good hygiene and

sanitation, including frequent hand washing, can help prevent human infections with swine influenza viruses. Protective clothing, gloves and other personal protective equipment also reduce exposure. When investigating a possible outbreak with the novel 2009 H1N1 virus, the Canadian Food Inspection Agency (CFIA) recommends that veterinarians use N95 masks, eye protection, gloves, impermeable coveralls, and protective clothing and footwear, in addition to using good hygiene and sanitation. There is no indication that any swine influenza virus can be acquired by eating well-cooked pork. Normal food safety precautions including hand washing before and after handling raw meat, the prevention of cross-contamination of foods or surfaces used for food preparation, and the use of hot soapy water to wash contaminated surfaces are protective for swine influenza viruses.

**PREVENTING INFECTION WITH NOVEL H1N1 VIRUSES CIRCULATING IN HUMANS**

Preventative measures include avoidance of contact with people who have flu-like illnesses, as well as frequent hand washing, avoidance of unnecessary hand contact with the eyes, nose or mouth, and other common sense hygiene measures. The mouth and nose should be covered with a tissue when coughing or sneezing, and the tissue should be discarded into the trash. In areas where outbreaks have been reported, crowded conditions and close contact with other people should be avoided. The elderly, young children and people who have chronic illnesses or immunocompromising conditions, including pregnancy, should be particularly cautious. People who have severe illness or are at high risk for complications should contact their physician to see whether testing and/or antiviral treatment would be appropriate. Antiviral drugs can be used for prophylaxis in high risk populations. People who are not in high risk groups but are in close contact with swine flu cases may be given antiviral drugs under some conditions. For example, health care workers or public health workers who have had unprotected close contact with a person shedding viruses may receive prophylaxis. Inactivated influenza vaccines are available for some influenza virus infections in pigs. These vaccines do not always prevent infection or virus shedding, but the disease is usually milder if it occurs. Influenza vaccines may change periodically to reflect the current subtypes and strains in a geographic area. In general, swine viruses display less antigenic drift than human viruses, and these vaccines are changed less often.

**REFERENCES**


1. Swine influenza, *World Organization for Animal Health [OIE]. Manual of diagnostic tests and vaccines for terrestrial animals [online]. Paris;OIE,* 2008
2. P. Heinen, Swine influenza: A Zoonosis. *Vet Sci Tomorrow [serial online],2003*
3. I. H. Brown, (OIE/FAO/EU International Reference Laboratory for Avian Influenza). *Influenza virus infections of pigs. Part 1: Swine, Avian & Human influenza viruses [monograph online],* 2006.
4. P. N. Acha and B. Szyfres, **580**, 155-72, 2003.
5. F. Fenner, P.A. Bachmann, E.P.J. Gibbs, F.A. Murphy, M.J. Studdert, D.O and White. *Veterinary Virology,* 473-484, 1987.
6. K. P. Myers, C. W. Olsen and G.C Gray, *Clin Infect Dis,* **44**, 1084-1088, 2007.
7. Centers for Disease Control and Prevention [CDC]. *HINlflu (swine flu),* 2009.
8. Swine influenza , *World Health Organization [WHO]* 2009.
9. H1N1 flu virus (human swine influenza) questions and answers, *Canadian Food Inspection Agency [CFIA]* 2009.
10. H. Yu, G.H. Zhang, R. H. Hua, Q. Zhang, T. Q Liu, M. Liao and G. Z. Tong, *Biochem Biophys Res Commun.* **356**, 91-96, 2007.

# CHEMISTRY OF DENDRIMERS : NUMEROUS APPLICATIONS IN REAL LIFE

H. Shekhar

**It is very tough to achieve 100% branching in monodispersed samples and macromolecules. The profound branching makes the materials unique for specialized applications. The objective of the paper is to highlight the different dendritic morphologies in different kind of materials.**

## INTRODUCTION

Now a day the molecular and macromolecular features based on dendritic structure are emerging in different disciplines. A new class of macromolecular architecture, dendrimers or dendritic polymers having nanostructure came into light in 1979 after the Ph.D. work of Donald A. Tomalia and later on the same research group was awarded the world's first dendrimer patents. These dendrimers heralded great promise for a wide range of real world application mostly notable in biotechnology and pharmaceuticals[1]. Recently, five generations of synthesized macromolecules of Dendri Graphated Lysine (DGL) have been reported[2], and a supramolecular material[3] is prepared by glycosylated amino acid which is capable of acting as a carrier matrix for thermally controlled release of DNA. The term dendrimer refers to macromolecules having very high degree of branched architecture with molecular weights of several kilo Daltons and stay near spherical steps. The chemistry of dendrimer has gradually become popular due to real life application of dendritic macromolecules. The presence of numerous end groups and hyper branching in the macromolecule are the characterizing features, which shows the potential applications[4-5] specially in drug delivery agents, catalysts, hybrid systems and nanotechnologies. Some novel materials not only differ in their chemical structures but do have a unique architecture to make it behave differently under any specific conditions. The highly hyper branched molecules show the differences significantly in their chemical property from the conventional linear and simple branched molecules and the profound branching make them unique for specialized applications. The mechanism of appearance of dendrites at material interface is very diverse and not so very clear. But the tree like branched is the compulsory propagation pattern in dendritic structure. The branched ordering schemes develop such a way where the dendrite emerges in spatial domain nucleation core centre, and known as primary arm, the first branch further becomes secondary and so on, with increasing order until the tips are reached. The enormous diversity in the structure, composition and plasticity of dendrites suggests that the functional contributions of these structures are enormously diverse. The diversity of structure of dendrites is due to different nuclei, sizes and shapes configurations and they are neighbours on the same parent dendrites. Several types of dendrites have been investigated earlier[6-8]. These shapes look clear stubby, thin and mushroom variety but many of them are the intermediate

Department of Chemistry, V.K.S. University, Ara, Pin- 802301, Bihar, India Email: hshe2503@rediffmail.com

between these shapes. For instance some dendrite has very long necks, while some have rather larger heads. The descriptive morphologies are spherical bushy, globular busy, stellate, bushy multipolar, octopous, crosslinked, hyper branched. The critical evidence for characterizing the evolution of mechanism of various dentric molecules has been investigated. For convenience the substances have been grouped as follows: (a) metals & alloys (b) inorganic compounds (c) organic compounds (d) polymeric materials (e) pharmaceuticals materials (f) spines.

Dendrimers are three dimensional macro-molecules consisting of a nucleating centre, a chain propagating unit and terminal end groups. They have a large number of symmetric branches with uniform segments, monodisperse molar masses and regular tree like topology, resulting from repetitive reaction sequences, such as the convergent and divergent synthetic approaches[9]. Dendrimers have been extensively studied in both material sciences and biomedical areas, such as adhesive, additives catalysts, metal complexes; drug and contrast agent carries gene transfer agent, synthetic vacancies and spines. Their role in catalytic, electronic, nano synthesis, surface coating, cancer and HIV treatment and diagnostics are significantly insighted. Dendritic structure is a common pattern during melt solidification which influences the microstructure and mechanical properties of materials obtained in casting. Therefore the development of dendrite is a key problem in material science because of the observability property. When crystal nucleus is under the state of undercooling, tip velocity and morphology can reflect dendritic growth. Both two and three dimensional approach for the dendritic structures have been forwarded with crystalline anisotropy like conventional dendrites. Weakly anisotropic materials such as organic and metallic systems above critical undercooling give dendric growth. Morphology of pure succinonitrile (fig 1) on solidification has been appeared dendritically in a diffusive regime

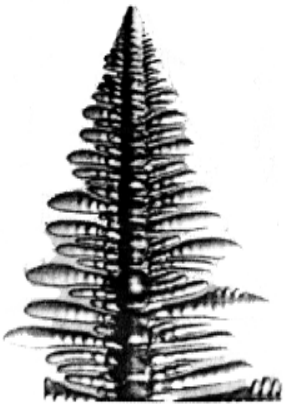


**Fig. 1.** *Microstructure of SCN × 50.*

in space. These days succinonitrile based binary organic materials have been used as model materials for binary metallic system because of low melting point and transparent characteristics in solid and liquid phase which is very important for unfolding the mysteries of dendritic solidification[10,11]. Succinonitrile appears with a very good dendritic structure due to low enthalpy of fusion of the material. Various dendtritic morphologies in mono & macromolecules have been described in the present communication.

## DENDRITIC ARCHITECTURE

Dendrimers are formed by the addition of shells of branched molecules to a central core. They are found nanoparticles and can be precisely designed and manufactured for a wide variety of applications. Numerous applications of dendrimers have been accounted due to different shape, size, configuration and different building blocks with different proportions. But always the most effort is being paid to begin the macromolecular substances with same building block in identical proportion. This may manifest the unique properties and macroscopic behaviour. Polydipersity is very usual in dendrimers and cause the bulk properties. But the creation of monodiperse materials is our best options. All the molecules in the sample are of identical size and

shape. Monodisperse samples would offer distinct physical features that, in essence, would be difficult to achieve through other polydisperse samples. An easy method to achieve a monodisperse macromolecule is through the formation of branches-upon-branches architecture throughout the macromolecule. It is important task to achieve 100% branching, so that a perfect monodispersed material can be built up. The structure feature of macromolecule is unique in comparison to other commercial synthetic polymers. The geometric characteristics of dendrimers remain ongoing research topics within polymer sequence. Natural occurring glycogen, a slow active energy storage macromolecules in living organism has a dendritic structure .The natural dendritic architecture of starch is due to presence of amylopectin while amylase consists of conventional linear structure. Dendritic structures of pure carbon tetra bromide, little percent impurity with salol, cyclohexanol and neopentyl alcohol have been observed quite clearly by chemists, physicists, material scientists & metallurgists. It was found that dendritic side branching in pure material is suppressed beyond secondary & tertiary branches. In dendrites growing from binary systems the branching leads to fourth or higher order with the side branches move slender than the main stem. This is due to thermal and chemical diffusivity ratio ($\alpha/D$) and the relaxation distance of the diffusion fields surround over dendrites during solidification. Direct observation of unidirectional solidification of 30 wt% ammonium chloride in water shows a streak like pattern visible on the side of the casting above the solidified zone which is jets of fluid forced up through the dendritic interface. Dendrites in Tin metal were observed the shape, tip radius and growth speed of slowly growing tin dendrite. It was found that tin dendrites grew with the speed range $10^{-2}$ to $3 \times 10^{-2}$ cm/sec and parabolic tip profile with radius of curvature between $4 \times 10^{-3}$ and $3 \times 10^{-3}$ cm respectively. During solidification many of side branching and dendrites have remelted and have become detached from the main dendrites stems. The effect of remelting occurs much more rapidly in metallic systems than in organic materials, because of the large value of $\alpha/D$ in metals. Despite the transparent organic materials ammonium chloride a inorganic molecular substance also freezes in such a manner as metals do.

The chemical structure of secondary amine is at present the focal point for each dendrons, moreover different contents of urea and amide linkages are present in inward section and periphery dependency on the size of the dendron. These hydrogen bonding rich groups provide diversified associated chains, which would be the ideal candidates for the formation of supramolecular structures. A dendritic architecture could be described by three distinct components (fig 2); (i) the core, (ii) the interior branches and (iii) the exterior functionalities. The assembly of these three components creates a

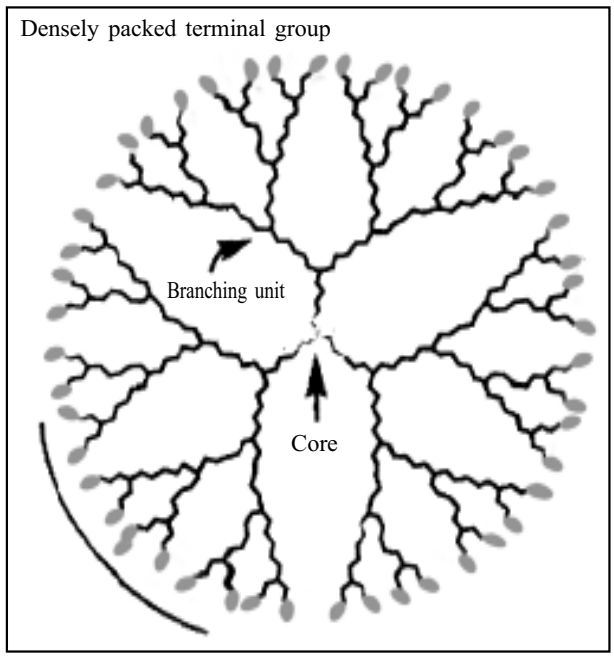



**Fig. 2.** *Dendritic architecture*

dendritic structure, which is radially symmetric and expands multifold generation, a circle shape enveloped by a set of branch points located symmetrically around the core. The various

generations of dendrimers are designed by the notation (G – x)nf, in which (G – x) is reffered to generation number (x = 0, 1, 2, 3, .....); n is the number of dendritic fragments connected to the core and f denoted the core moiety at the focal point. The symmetric branching results in (i) exponential growth of the dendritic structure leading to an exponential increase in the molecular weights with increasing generations, (ii) dense exterior regions and (iii) relatively less-dense interior regions. The growth proceeds to dense exterior and less dense interior regions within the structure, especially at higher generations. The structure of PAMAM (polyamidoamine) with ethylenediamine is shown in (fig. 3) while (fig. 4) shows the dendritic structure of polyurethane elastomers

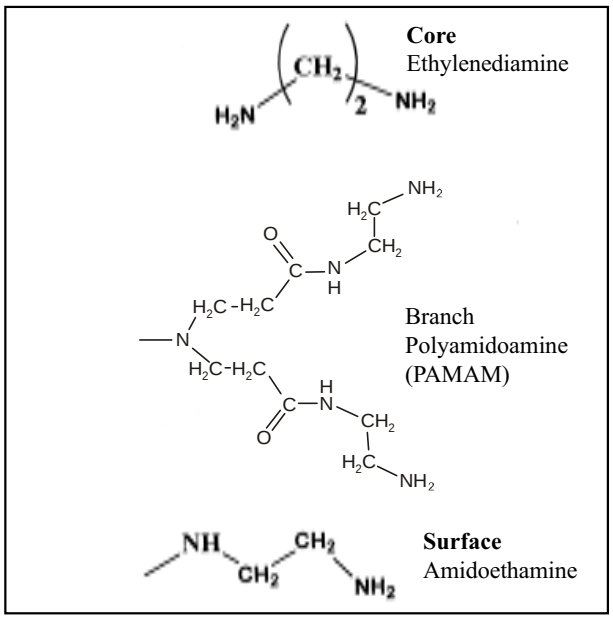



**Fig. 3.** *Dendritric structure of polyamidoamine branch with ethylenediamine core*

through multi hydrogen bonded association and synthesized by convergent method[12]. At very high undercoolings dendrites are fragmentated and the dendritic trunk diameter becomes very fine and show the appearance of very fine-grained structure fragmentation leads when the characteristic for dendrite breakup is shorter than the post recalescence or platur time in overall agreement. The fragmentation of dendrites is also induced by convection, diffusion, microsegregation, interface dynamics etc.

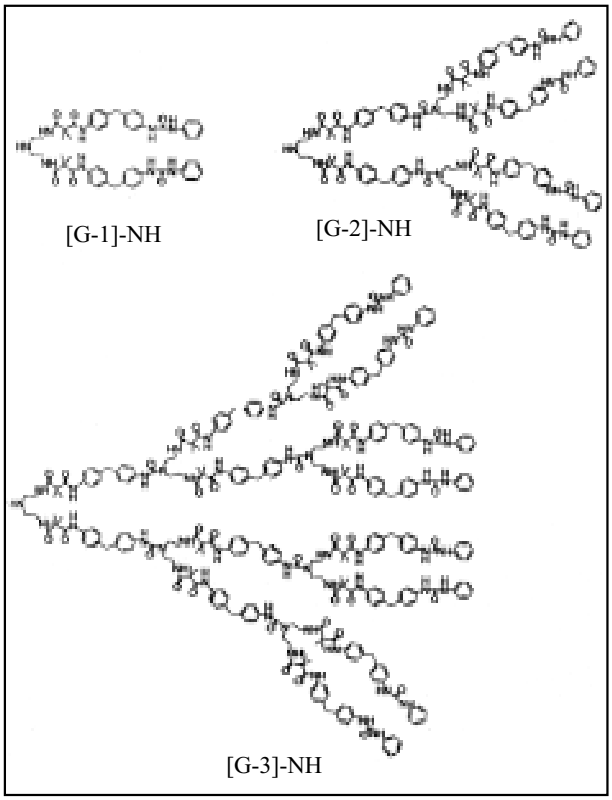



**Fig. 4.** *Chemical structures of [G-1]-NH, [G-2]-NH and [G-3]-NH polyurea/malonamide dendrons*

## APPLICATION

The proper fitment of the chemical properties of their core, shells, and surface layer can tailor dendrimers to fit the needs of specific applications. Because of precise architecture and construction in dendrimers they possess inherently valuable physical, chemical and biological properties, uniquely suited to drug diagnostics and drug delivery. Dendrimers have demonstrated rapid transport capabilities across biological membranes. They branch out in a highly predictable fashion to form amplified three dimensional structures with highly ordered architectures. These structures can be used to carry and store a wide range of metals, organic or inorganic molecules by encapsulation

and absorption. The synthetic process has been used to produce dendrimers with uniform sizes, precisely defined surface functionality, and very low impurity levels. Most dendrimer systems display very low cytotoxicity levels and commonly manifest a very low or negligible immunogenic response when injected or used topically. The high level of control over the dendrimer architecture makes ideal carriers for the active pharmaceutical ingredients in areas such as drug delivery, diagnostic/imaging and gene transfection and has demonstrated excellent potential as metal chelates. Analysis of dendrimer-chelate structure on retention and distribution has led to the discovery of the unique ability to control pharmacokinetic behaviour by tuning dendrimer size and surface functionality. Polyamidoamine (PAMAM) dendrimers, which have been used to deliver nucleic acids, a characteristic novelties associated with a superior, next generation transfection agent-characteristics such as amenability to nucleic acid complexation,

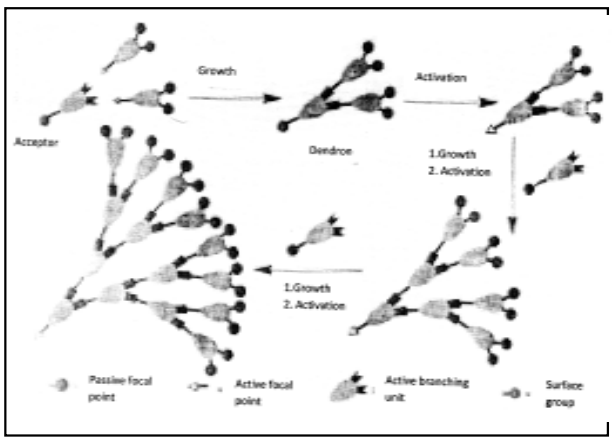



**Fig. 5.** *Construction of dendrons*

chemical modification and targeting, transfection enhancing, and/or fluorescent molecule conjugation. Dendrimers provide the necessary interface between chemistry and biology, possessing the unique traits to act as safe and effective drug-delivery vehicles as well as highly sophisticated diagnostic imaging agents. In the biotechnology and drug fields, these highly adaptable structures have finally taken nanotechnology from the theoretical into the practical. In fact, dendrimers have already been commercialized in products designed for HIV prevention, anthrax detection, cardiac-marker diagnostics and gene transfection. The direct application of drug dendrimers affects the drug to all sections. Drugs can be attached directly to the dendrimers. Alternatively, the drugs can be encapsulated into the dendritic structure, which can then be released at the required cellular site for pharmacological action by an applied stimulus.The high drug-loading capacity and abilities to optimize the dendritic components facilitate the needs of physiological requirements and flexibilities to incorporate specific targeting devices. The effect of enzyme or light or chemical action degrades the dendrimer structure so as to release the drug molecules.

Dendrite spines[13] have fascinated neuro scientists by their structure and their possible functional roles in human brain. Spines are swelling of the dendritic tree (0.5 μm in length) or protrusions emerging from the dendrite of neurons and represent the primary post synaptic targets of excitatory glutamatargic inputs in adult brain. The enormous diversity in the structure, composition, and plasticity of dendrites and their synaptic specializations suggests that the functional contributions of these structures to mind and brain are enormously diverse (fig 6) and so many brain arbitraries may be relaxed by controlling the dendrites in spines.

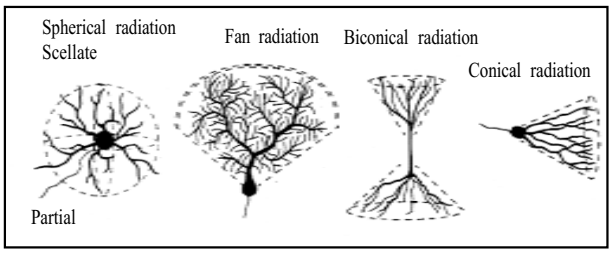



**Fig. 6.** *Different directions of dendritic growth in spines*

Dendritic branches of highly spinous multipolar neurons have been observed in the wulst of the Japanese quail. The moderately spinous multipolar

neurons with dendritic architecture running in all directions and covered with small stalk spine like small head have emerged in the hippocampal complex and corticoid complex of zebra finch and strawberry finch[14]. Dendritic model has been extended to welding of materials. In this way critical growth conditions for single crystalline welding[15] of single crystal gas turbine blades could be established and potentially interesting process for lifetime extension of these expensive components developed. Dendrite morphology was observed in bulk samples of iron and nickel base alloys under-cooled up to 300°C. The dendrite morphology of the alloy gradually changes with increasing under-cooling[16] from the usual dendritic structure to a structure composed of cylindrical dendrite arms. At a critical under-cooling of approximately 170°C in these alloys there is an abrupt transition to a fine-grained structure of spherical morphology. Final dendrites-arm spacing of melts nucleated at less than the critical undercooling decreases with increasing undercooling and with decreasing distance from a chilled surface. It is inferred that structure coarsening with reduction of surface area as driving force, is the principal mechanism for determining final dendrite-arm spacing in melts nucleated at small undercoolings and grain size in melts nucleated at large undercoolings.

## CONCLUSION

For curing a patient safely and painlessly from invasive surgical and painful treatments, the dendrimer nanoparticles may have great potential to destroy the diseased cells of the bodies and save their life. The microlevel dosage of the required drugs for the targeting diseases is the other significance of the macromolecular dendrimers.

## REFERENCES


1. J. M. J. Frechet and D. A. Tomalia, Dendrimers and other Dendritic polymers, 2001, John Wiley & Suns, Chichester.
2. C. C. Lee, J A Mackay, J. M. Frechet and F. C. Szoka, *Natural biotech,* **23**, 1514, 2005.
3. S. Kiyonaka, K. Sugiyasu, S. Shinkai and I. Himachi, *J. Am. Chem. Soc,* **124**, 10954, 2002.
4. C. P. Chen, S. A. Dai. R. J. Jeng, W. C. Su and H. L. Chang, *J. Polym. Sci., polymchem,* **43**, 682, 2005.
5. E. R. Callies and J. M. J. Frechat, *Drug Discovery Today.* **10,** 35, 2005.
6. M. E. Glicksman, M. B. Koss and E. A. Winsa, *Phys. Rev. Lett.* **73,** 573-580, 1994
7. S. G. Kim and W. T. Kim, *J. Cyst. Growth,* **275**, 355-360, 2005.
8. Ajit K. Banthia, Proc. Int. Conf. Advancements in polymeric material **5,** 2010.
9. N. Jayaraman, *Resonance,* Jan, 60-66, 2007.
10. U. S. Rai and H. Shekhar, *Cryst. Res. Technol,* **25**, 1425, 1990.
11. E. Ustun, E. Cadirli and H. Kaya, *J. Phys. Condens Matter,* **18,** 7825, 2006.
12. G. Coussot, E. Nicol, A. Commeyras, I. Desvignes, R. Pascal and O. V. Trambouze, *Polym. Int.* **58**, 511-518,2009.
13. R. A. Mckinney, *Biochemical Society Transactions,* **33,** 1299-1302, 2005.
14. P. Chand and U. C. Srivastava, *Nat. Acad. Sci. Lett.,* **33**, 377, 2010.
15. W. J. Boettinger, S.R Coriell, A. L. Greer, A. Karma, W. Kurz, M. Rampaz and R Trivedy, *Acta,Mater,* **48,** 43, 2000.
16. C. B. Arnold, M. Aziz, M. Schwarz and D. Herlach, *Phys. Rev.,* **859**, 334, 1999.

## KNOW THY INSTITUTIONS

### FOREST RESEARCH INSTITUTE, DEHRADUN

Forest Research Institute (FRI), Dehradun has its roots in the erstwhile Imperial Forest Research Institute established in 1906 to organize and lead forestry research activities in the country. Its history is synonymous with the evolution and development of scientific forestry not only in India but in the entire Indian subcontinent. The institute also administered training to forest officers and forest rangers in the country and after independence it was aptly renamed Forest Research Institute and Colleges. In 1988 FRI and its research centers were brought under the administrative umbrella of Indian Council of Forestry Research & Education (ICFRE) under the Ministry of Environment and Forests, Government of India.

The institute, set in sylvan surroundings of the Doon Valley, has a campus spread over about 500 hectares. The main building completed in 1929, is an impressive edifice of the Greco Roman and Oriental architecture spread over a plinth area of 2.5 hectares, with the outer Himalayas forming its backdrop.

FRI is an ISO 9001 : 2008 certified organization and at the regional level is responsible for the forestry research needs of the States of Uttarakhand, Uttar Pradesh, Haryana, Punjab, Chandigarh, and Delhi. With its focus on the most populous and agriculturally most developed areas in the country, the institute is poised to achieve greater heights in finding solutions to forestry and environmental problems of the country. Its mandate includes research in ecology, regeneration, tending and management of forests, utilization of forest products including non-wood forest products, forest inventory methods, watershed management, environmental sciences, forestry operations relating to nursery,

planting, tending, harvesting and transport. In addition, the institute continues to provide leadership in research areas relating to plant systematics, forest pathology, forest entomology, forest soil, application of biotechnology in forestry, climate change and bio-informatics.

The institute has a unique photo gallery in City center that probably is the only gallery where the wholeness of Indian Forestry has been documented in photographs. The gallery remains open for one and all throughout the year.

An INSAT up-linked Micro Meteorological Tower is installed in the institute to gauge and model the physical and biological process controlling mass and energy exchange between tree canopy and the atmosphere. The institute is also working with several organizations at international level.

The institute is committed to achieve continual improvement through the following objectives :

1. Generation and dissemination of the knowledge for construction, development and sustainable management of forest resources and environmental protection.
2. Customer satisfaction through timely delivery of quality products and services.
3. Human resource development through quality education and training.

**RESEARCH PRIORITIES**

The main thrust of current research is to develop technologies for :

(i) Enhancement of forest productivity, (ii) Improvement of planting stock, (iii) Rehabilitation of wastelands, (iv) Efficient utilization of wood and non-wood forest products, (v) Development of eco-friendly products and process.

**RESEARCH DIVISIONS**

(i) Botany, (ii) Cellulose and Paper, (iii) Chemistry, (iv) Climate Change and Forest Influences, (v) Ecology and Environment, (vi) Entomology, (vii) Extension, (viii) Forest informatics, (ix) Forest Pathology, (x) Forest Products, (xi) Forest Soil and Land Reclamation, (xii) Genetics and Tree Propagation, (xiii) Non-Wood Forest Products, (xiv) Resource Survey and Management, (xv) Silviculture.

**IMPORTANT TECHNOLOGIES DEVELOPED**

- A process for isolation of ursolic acid from Eucalyptus hybrid leaves
- A process for preparation of Katha from *Uncaria gambler*
- ACA treatment of Eucalyptus door and window sections
- Agro-foresty models
- An adhesive for agarbatti making
- Biofertilizer application for growth enhancement in nurseries
- Cultivation and processing of selected medicinal plants of forest origin
- Eco-friendly hair dye
- Eco-friendly wood preservatives
- Fast fluctuating process for treatment of green wood
- Fumed furniture, joinery and handicrafts from Eucalyptus
- Greening of barren sodic soils
- Improved tools for nursery practices
- Jigat substitute of agarbatti
- Laminated wood for door and window shutters from poplar
- Natural dyes from forest biomass
- New technology for mass propagation of Bamboos through macro-proliferation
- Non-destructive harvesting methods of medicinal plants
- Process for preparation of compost from plant biomass
- Rehabilitation and eco-restoration of mined lands/ over burden spoils

- Reshaping of gums
- Resin tapping techniques
- Sawing and seasoning technique of Eucalyptus wood
- Seed collection, processing and storage technique
- Simple and effective process for isolation of bioactive Hederagenin
- Solar heated timber-seasoning kiln
- Utilization of Eucalyptus and Poplar
- Wood plasticization and bending through vapour phase ammonia treatment

**RECENT ADVANCES**

- A herbal product named 'SAMRIDDHI' for enhanced silk production
- Biological control of diseases in nurseries
- Clonal propagation of difficult to root forest species and low cost clonal propagation technologies
- Conservation of heritage trees
- Development of fire fighting tools
- DNA finger printing technique for forest tree species
- Forests and climate change
- Marker constituents conferring CLSB disease resistance to the leaves of hybrid bred from *Eucalyptus citriodora* and *E. torelliana*
- Natural durability of timber and timber products under terrestrial and cooling towers conditions
- Preservation of heritage trees of Ta Prohm (Tree Temple) in Cambodia
- Research on high oil yielding plants *of Jatropha curcas* for biofuels
- Research on Lesser Known Tree Species , potentially important from ecological, socio-economic and / or trade
- Tissue culture protocol for important bamboo/ tree species

**SCIENTIFIC SERVICES**

- Consultancy and training to industries on use of new raw materials, processing techniques, economic eco-friendly methods of wood processing and wood utilization
- Culture collection of about 1000 isolates of forest fungi
- Database on properties of over 400 timber species
- Development of model village
- Entomological reference collection with over 23,000 insect species
- Establishment of Van Vigyan Kendra
- Germplasm collection of about 100 medicinal and aromatic plants
- Herbarium with 3,30,000 plant specimens including carpological collection
- *In situ* advice on problems of factory processes and diagnostic analysis
- Maintenance of Arboretum, Bamboosetum and Botanical garden
- National Forest Library and Information Center
- Phytosanitary certificate
- Rules for testing seeds of over 80 tree species
- Seasoning, preservative treatment and sowing of wood on commercial basis
- Timber price survey of over 15 species in 12 markets
- 76 volume tables and 26 yield tables
- Wood identification, testing and quality control of timber and timber products
- Xylarium with 20,000 wood samples

**SHORT TERM TRAINING COURSES**

For officers and scientists

- Agroforestry
- Agroforestry and landscaping
- Classification and grading of timber

- Commercial utilization and value addition of non- wood forest produce
- Cultivation and utilization of medicinal plants
- Development of Green Belts
- Eco-restoration of wastelands
- Exposure to field identification of timbers
- Genetically improved materials for increasing forest productivity
- Hi- tech nursery and plantation management
- Management of Forest Herbarium and Arboreta
- Nursery and plantation technology
- Plywood manufacture
- Wood seasoning

For Field Staff of Forest Departments , other Govt. Departments, NGOs, Farmers, SHGs, VFC members :— ● Bamboo utilization ● Cultivation of medicinal plants ● Nursery and plantation technology ● Rural development technologies

**FRI MUSEUMS**

Forest Research Institute has six museums, approximately 80,000 visitors visit these museums every year.

(i) Entomology, (ii) Forest Pathology, (iii) Non -Wood Forest Products, (iv) Silviculture, (v) Social Forestry, (vi) Timber.

**FRI UNIVERSITY**

Forest Research Institute has been conferred the status of Deemed University on the recommendation of University Grants Commission, Ministry of Human Resource Development, Govt. of India since 1991. The University provides hostel, library, computer, laboratory, medical and sport facilities to all its students within the campus. The courses being run by the FRI Deemed University are:

**Two Year Degree Courses**

- M.Sc. (Environment Management) ● M.Sc. (Forestry) ● M.Sc. (Wood Science and Technology)

**One Year Diploma Courses**

- Post Graduate Diploma in Aroma Technology
- Post Graduate Diploma in Pulp and Paper Technology
- Post Master Diploma in Natural Resource Management

**Doctoral Programme**

Under the Doctoral Programme the FRI Deemed University confers Ph.D. Degrees in various fields related to forestry, wildlife and environment. Several national institutes located in different parts of India are research centers of FRI Deemed University. The University provides hostel, library, computer, laboratory, medicinal and sports facilities to all its students within the campus.

*For more information please write to :*

Head, Extension Division
Forest Research Institute
P.O. New Forest
DehraDun 248006, Uttarakhand, India
Phone; 0135 2758606; Fax; 0135 2756865
Email:headext@icfre.org
Website :
http://www.icfre.gov.in;http://www.fri.icfre.org

# LIFE SKETCHES OF OFFICE BEARERS AND SECTIONAL PRESIDENTS OF THE INDIAN SCIENCE CONGRESS ASSOCIATION, 2011-2012

**PROF. GEETHA BALI**
**General President**

Prof. Geetha Bali, Vice Chancellor, Karnataka State Women's University, Bijapur graduated from Bangalore University and obtained Ph.D. degree working in the field of Neurophysiology. Her major contributions are in the field of Neuroethology and Neurodegenerative disorders. Prior to her appointment as the Vice Chancellor, she was serving as Professor, Department of Biotechnology, Co-ordinator, Center for Clean Environment Technology which was founded by her and Co-ordinator, Bioinformatics facility at Bangalore University. She carried post-doctoral research in many prestigious institutions including Clinical Brain Disorders Branch, Neuroscience Centre, National Institutes of Health., Bethesda, MD, USA., University of Maryland Biotechnology Institute, College Park., MD.,USA and Insect Neurohormone Laboratory, USDA, Beltsville, USA. She has published several papers in reputed journals and written books and has guided several students for Ph.D. two of whom were awarded Jawaharlal Nehru Award of ICAR for their doctoral work. She was responsible for establishing strong linkages between a number of reputed institutions in the USA and Bangalore University resulting in faculty and student exchange and training programmes and collaborative research and she served as Asia coordinator for a multinational project funded by USDA, USA. She has a number of recognitions, national and international, to her credit for her contributions in science and for education. She was awarded Young Scientists' career award by the UGC. She was honoured as IFAS scholar by the University of Florida, Gainesville, USA. She is a Fellow of the Alexander von Humboldt Foundation, Germany and continues to collaborate with institutions in Germany. She was appointed as a Fellow of Salzburg Seminar, Austria. As Vice Chancellor of Karnataka State Women's University, she has implemented a number of innovative programmes including the establishment of "Koushalya Women's Technology Park", the only one of its kind in any Indian University, with a variety of facilities serving as skill training, awareness creating and research centres as well as business incubators enabling women to benefit from science and technology. She was awarded Star News B School award 2011. She has served the Indian Science Congress Association in various capacities as chapter convenor, sectional president and member of the governing bodies before being elected as the 99$^{th}$ General President. She is the fourth woman to be so elected. She is a Fellow of the National Academy of Sciences, India.

**DR. MANOJ KUMAR CHAKRABARTI**
**General Secretary (Membership Affairs)**

Dr. Manoj Kumar Chakrabarti is the Deputy Director (Senior Grade) of the National Institute of Cholera and Enteric Diseases, Kolkata. He did his M.Sc. from University of Calcutta and in 1982 received his Ph.D. degree from the same University. He did postdoctoral research on the mechanism of action of *E.coli* heat-stable enterotoxin at the Department of Microbiology, University of Kansas, USA. He also worked at the Department of Bacteriology of Nagasaki University, Japan.

Dr. Chakrabarti has contributed in the understanding of pathogenesis of different diarrhoeagenic bacteria, development of vaccine, Super ORS and use of proper antibiotics against diarrhoea. His current research interest is investigation of receptor specificity and signal transduction of different bacterial toxins. He is also working towards the development of a candidate vaccine against shigellosis. He has been working on different projects some of which are as follows: One of his studies reveal that oral immunization of rabbits by heat killed *Shigella flexneri* 2a can give 100% protection against shigellosis. 34kDa outer membrane protein (OMP) has been identified as a protective antigen. Recombinant 34 kDa protein has been found to be cross-reactive, surface exposed and induces protective immune responses, which are the criteria of an optimal vaccine antigen. This study may lead to develop a simple, practical and effective vaccine against shigellosis. Furthermore, it has been shown that the protein is antigenically conserved among *Shigella* spp., and hence can be used to develop a diagnostic kit. In another study the intracellular signal transduction pathway involved in the induction of intestinal secretion by *E.coli* heat-stable toxin (STa) has been evaluated. It has been shown that besides cyclic Guanosine - 3', 5'- mono phosphate *E.coli* STa also involves phosphatidyl-inositol specific phospholipase C, inositol trisphosphate, diacylglycerol, calcium and protein kinase C-$\alpha$ in its mechanism of action in a human colonic carcinoma cell line COLO-205. Recently, it has been found that actin cytoskeleton network plays a crucial role in the activation and translocation of PKC-$\alpha$. Recently, it has also been shown that *E.coli* STa downregulates the cell proliferation through Protein Kinase G-Mitogen Activated Protein Kinase pathway and has been considered as a potent anti-angiogenic and anti-metastatic molecule.

Apart from this, he is also involved in teaching and other academic activities of different Universities and professional societies in India. A large number of students have been trained by him for their Ph.D. / M.Sc. / M.Tech. program. Several collaborative projects are also going on with many National and International Scientists of different Organizations and Institutes and published several papers in National and International Journals of repute.

He has participated as WHO sponsored inter-country course facilitator and guest lecturer on various pathophysiological aspects of diarrhoea. Dr. Chakrabarti acted as a resource person on various orientation/refresher programmes of Academic Staff College of different Universities. He has been invited to deliver talks and to chair Sessions in Microbiology and Immunology in different National and International Conferences and has been serving as a member of the Editorial Board of the three Indian Journals and reviewer of different International Journals.

Dr. Chakrabarti is serving as Vice-President of the Physiological Society of India. He was the president of the Section of Physiology (presently Medical Sciences including Physiology) during 89th Session of Indian Science Congress, 2001-2002. He has been elected as Fellow of West Bengal Academy of Science and Technology in 2001 for his contribution in research on pathogenesis of diarrheal diseases. Presently, Dr. Chakrabarti is the convener of Medical and Veterinary Sciences section of the Academy. He was awarded Ramendra Sundar Sinha Memorial oration of 1999 by the PSI, Platinum Jubilee oration of 2007 by Indian Science Congress and Prof. A.K. Mukherjee Memorial award in 2007. He was the Convener of ISCA Kolkata Chapter from 2007 to 2010

**DR. (MRS.) VIJAY LAXMI SAXENA**
**General Secretary (Scientific Activities)**

Dr. Vijay Laxmi Saxena is at present Head of the Department of Zoology, D. G. College, C.S.J.M. University, Kanpur. She was appointed as Lecturer in Zoology Women's College B.H.U. Varanasi, worked in P.P.N. College, Kanpur for 3 sessions, worked as a lecturer in A.N.D. College, Kanpur and joined Dept. of Zoology, D.G. College, Kanpur in 1983 and working there till to date.

Dr. Saxena had held different posts in different organizations like General Secretary-Indian Society of Life Sciences from 2008-2010, Convener, Kanpur Chapter, ISCA from 2007-2010, Elected Executive Committee Member of ISCA from 2006-2009, Elected Council Member of ISCA from 2005-2006, Elected Recorder of the Section of Zoology, Entomology & Fisheries of ISCA in 1996-1998, Elected Member of the Section of Zoology, Entomology & Fisheries of ISCA in 1994-1996.

Dr. Saxena has received several Awards/Prizes like Women Scientist Award for the year 2009-2010, Certificate of Award for outstanding contribution for advancement of Science and Welfare, Certificate of Honour from Society of Pest Management & Environment Protection, Winner of Gold Medal award of Indian Society of Life Sciences, etc.

Dr. Saxena has research experience of 36 years and teaching experience of 29 years. Twenty six students have obtained Ph. D under her guidance. She has fifty three papers in journals of National and International repute and edited twenty books. She is a member of several professional bodies and have participated and presented papers in several National and International Symposia/ Seminar and also gave invited talks in South Korea. She has travelled worldwide i.e. Italy, Paris, Germany, Innsbruck, Malaysia, Austria, Singapore, South Korea and America, Chaired several Sessions and also as a Resource person conducted many research projects funded by U.G.C, D.S.T. and J.S.P.S. (Japanese Society for Promotion of Science). She was Coordinator N.S.S., C.S.J.M. Univ., Kanpur, organized National Integration Camp, C.S.J.M. Univ., Kanpur, participated as Contingent Leader in All India N.S.S. Republic Day Parade and Camp, New Delhi, Organized Aids Symposium sponsored by N.S.S. Regional Centre, Lucknow, organized Life Style Education Centre Workshop, organized Aids Rally and Poster Competition sponsored by U.T.A., N.S.S. Regional Centre, Lucknow, and Member of University Advisory Committee (N.S.S.) of C.S.J.M. Univ., Kanpur and coordinator Bioinformatics Infastructure Facility Centre of DBT (Govt. of India).

**SRI NILANGSHU BHUSAN BASU**

**Treasurer**

Born on 14th day of July, 1956, Sri Nilangshu Bhusan Basu graduated in Civil Engineering from Bengal Engineering College in the year 1977 with distinction. He completed Master's degree in Structural Engineering from Jadavpur University in the year 1983 with distinction and successfully undergone training in River Basin Management at Thames Water Authority, U. K. in the year 1989 with Commonwealth Scholarship. He is serving as Chairman of Architectural Engg. Division of Institute of Engineers, West Bengal Chapter. He is also adorning the honoured post of the Vice President at the Institute of Public Health Engineers. Presently, he is working at The Kolkata Municipal Corporation in the capacity of the Principal Chief Engineer (civil). Under the supervision of his Engineering skills a good number of infrastructure projects for the city of Kolkata have been completed successfully. 40 MGD water treatment plant at Palta, 100 MGD pressure station for clear water at Palta 100 MGD intake jetty with intake station of Palta, Networking for water mains, Booster pumping stations at Parkcircus, Bagmari, Ranikuthi, Kalighat Drainage pumping station of Southern Avenue, Automated computerized car parking system at Roudan street (over ground) at Lindsay street (underground) etc. are only a few among the large number of successful projects that he has so far undertaken. All the JNNURM projects of KMC worth Rs. 1000 crores have also formulated and is being executed in his leadership.These prestigious projects include 132 year old U.G. sewer rehabilitation of Kolkata also.

**DR. AJAY PARIDA**

**President**

**Section of Agriculture and Forestry Sciences**

Dr. Ajay Parida is the Executive Director of the M.S. Swaminathan Research Foundation. Dr. Parida had his early education in Orissa. He has worked on the cytogenetic and molecular basis of species differentiation in few annual leguminous species for Ph.D. degree and subsequently on molecular variation in *in-vivo* and *in-vitro* tree systems, at the University of Delhi. Dr. Parida has considerable experience in project management and leading research and development projects. A plant biotechnologist by training Dr. Parida joined the M. S. Swaminathan Research Foundation in 1993.

Dr. Parida and his group have made outstanding contribution in the area of Coastal Ecosystem management through integrated use of traditional and modern biotechnologies and have successfully utilized molecular marker systems in mangrove species in understanding species relationship, developing unambiguous species identification systems, depicting population genetic structure and evolving site-specific conservation strategies.

His work on genetic indexing of wild relatives and land races of cultivated legumes, millet species and Rice has contributed to the understanding of genetic structure of the species/ populations. His ongoing work on identification, characterization and transfer of novel genetic combinations from mangroves has resulted in isolation of a number of genes for abiotic stress tolerance from *Avicennia marina.* Large scale sequencing of ESTs has been undertaken from *Avicennia marina, Porteresia coarctata and Prosopis juliflora.* Transformation and Transgenic systems in *Brassica, Vigna* and Rice incorporating some of the isolated genes are in different stages of development. This work has far reaching implications in developing location specific crop varieties offering resistance/ tolerance to coastal salinity.

Dr. Parida has guided/ guiding over Twenty Ph.D., students and published over 60 peer reviewed research papers, and many in books and conferences and seminar proceedings. Dr. Parida has played major role in organization of several multistakeholder dialogues in the area of biotechnology application, dissemination and biosafety issues. He has served on the National Biosafety Regulatory Committee and currently a member of advisory board of the BINAS Biosafety Network of the UNIDO.

Dr. Parida is Elected Fellow of the National Academy of Agriculture Sciences (NAAS) and National Academy of Sciences of India (NASI). He is a recipient of Prof. Umakant Sinha Memorial Award of the Indian Science Congress, B. M. Birla Prize of the Birla Science Foundation, National Biosciences Award of the Depertment of Biotechnology, Govt. of India, NASI-Reliance Award for Application Oriented Research and TATA innovation Fellowship. Dr. Parida Serves on many committees of the Govt. of India, and many International organizations.

**PROF. Y. K. KHILLARE**

**President**

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

Prof. Y. K. Khillare born in 1956 completed his graduate with Zoology honours in 1979, post graduate in Zoology with Fishery science as specialization. He has completed Ph. D. in the specialized area of research in Aquatic toxicology and fish biology and carried out his research leading to Ph.D. on the topic "Toxicological effects of pesticides in freshwater fish, *Puntius ticto*" from then Marathwada University, Aurangabad. He underwent a special training on aquatic toxicology offered by Dutch Scientific community, Utrecht University, The Netherlands in 1981 at NEERI, Nagpur, India.

He was also a post doctoral fellow in Fish Biology at Hel Marine research station, Gdansk University, The Hel, Poland with Prof. E. Skora, under Indo-Polish scientific exchange program in the year 1995-96 Government. He has also worked in as a panel expert on aquatic pollution studies at National Institute of Coastal Fisheries, Sweden with Prof. Erik Neuoman under Indo-swedish program in 1996. He is working as coordinator for the International MoU program with Prof. Hubert, Limoges University, France, Prof. Lucin Pawlowski, Lublin University of Technology, Lublin, Poland, Dr. Ravi Gooneratne, Linclon University, New Zealand and Ato Lakew Wondimu, Ambo

University Ambo, Ethiopia He has joined the Department in 1985 as a lecturer and became reader in 1995, subsequently got selected as Professor of Zoology in 1996. He became Professor and Head in 1998-2000, Director Students' Welfare, 2000-2002.

Prof. Khillare has received awards like, Best paper presentation award by Academy of Environmental Biology, Muzaffarpur, Young Scientist award by Dutch Scientific Society, The Netherland, Late Chief Minister, Shri Vasantrao Naik felicitation award for the contribution in fishery development in state. A Special award by National Environmentalists Association, Ranchi, Life time achievement Shankarrao Bajirao Patil, through Association of Zoologists, Indapur, Pune award instituted by then Finance Minister of State, Shri Harshvardhan Patil. He is also a recipient of gold medals like, Academy of Environmental Science, and Zoological Society of India. He has completed more than 10 minor research projects and two major projects, UGC, New Delhi. He has written three books in the field like environmental pollution and fishery biology and has published 67 papers in reputed National and International journals.

**PROF. TARNI JEE**

**President**

**Section of Anthropological & Behavioural Sciences (including Archeology, Psychology, Educational Sciences and Military Sciences)**

Prof. Tarni Jee was born on 09th January, 1955 in Hazipur Billour, a village in the district of state capital Patna. He obtained B.A.(Honours) in Psychology, LL.B.(MU) and Ph.D. degree from Patna University, Patna.

Prof. Tarni Jee started his research-cum-teaching career at the Psychology Department of Magadh University, Bodh Gaya in 1978. To serve the people of rural area of Bihar he joined as Lecturer in Department of Psychology, R.R.S. College, Mokama and Barh in January 1979. Since then he is actively engaged in teaching and research. Presently he is Head, P.G. Centre of Psychology, College of Commerce, Patna (Magadh University). His long and illustrious academic and research experience spans around 34 years in the field of Psychology and Education. He has published over 30 research papers in reputed national and international research journals. He has participated in International level seminars and symposium in a number of states. He has supervised M.Phil, and Ph.D. students.

Prof. Tarni Jee has made significant research contribution in Psychometry. His research work on National Verbal Intelligence Test (NVIT) has been acknowledged at National and International forum. He has developed more than half a dozen Attitude Scales (Privatization, Social Justice, Computerization, AIDS Awareness, Work Culture, Mental Health) and these scales are used by the M.Phil, and Ph.D. research scholars of Magadh University, Nalanda Open University and Annamalai University. He is the Editor of 'Behavioural Research Review' and Patron of journal 'Educational Science Review'; Publisher of Journal 'Indian Social and Psychological Studies' and Member of Editorial Board of over a dozen research journals.

Prof. Tarni Jee has delivered invited talks, Plenary lecture, Presidential Address, Key note address, Valedictory address. He is on the Advisory Board of/Chairman to many Organization, Member of Board of Studies, Research Committees and

Governing Council of several institutions, External Evaluator/ Visiting Faculty of more than 25 Universities and institutes of national repute.

Prof. Tarni Jee has been closely associated with the Indian Science Congress Association for almost four decades and was Recorder at Bangalore 90th Science Congress ISCA. He has very active interest in popularizing Behaviournal Sciences among schools, colleges and University level students.

**PROF. (DR.) A. K. BAKHSHI**

**President**

**Section of Chemical Sciences**

Prof. A. K. Bakhshi is presently Vice Chancellor of Uttar Pradesh Rajarshi Tandon Open University, Allahabad. Prior to this he was Head of the Chemistry Department, University of Delhi where he held the prestigious Sir Shankar Lal Chair of Chemistry since 1996. A double gold medalist of Delhi University, Dr. Bakhshi did his post-doctoral training at the University of Erlangen-Nurnberg, Germany with Prof. J. Ladik and at the Kyoto University and the Institute of Fundamental Chemistry, Kyoto, Japan with Professor K. Fukui, the Nobel Laureate and Prof. T.Yamabe. He has also been a Visiting Scientist at the Tata Institute of Fundamental Research, Mumbai and the Indian Institute of Science, Bangaluru.

Prof. Bakhshi's research interests include theoretical polymer chemistry with special reference to electrically conducting polymers and biopolymers. He is the author/coauthor of more than 140 research and education articles, five books/ monographs and one patent. He has made very significant contributions in his areas of research. Many students have obtained their Ph.D./ M.Phil. under his guidance. His most significant contribution has been in developing an insight into the structure-property relationship in electrically conducting polymers. These results are important guidelines for molecular designing of novel electrically conducting polymers. Prof. Bakhshi has also shown on the basis of his calculations, the existence of a high probability of hopping conductivity in proteins as the mechanism of energy transport. These results have significantly added to understanding of oxygen metabolism in humans and/or photosynthesis in plants.

Prof. Bakhshi has been conferred with several awards and academic honours. These include : Fellowship of the IUPAC; Distinguished Teacher Award; Chemical Research Society of India (CRSI) Medal; Fellowship of the National Academy of Sciences (FNASc); JSPS Fellowship; DAAD Fellowship; INSA Research Fellowship; UGC Career Award; Prof. P.K.Bose Memorial Award of the Indian Chemical Society, Best Paper Award in the field of Chemical Sciences from DAAD; Young Chemist Award; Dr. Krishan Rao Gold Medal, Dr. R. D. Desai Award of the Indian Chemical Society, Prof. R.P. Mitra Gold Medal etc.

Prof. Bakhshi has delivered many Invited Talks / Plenary Lectures / Keynote Addresses and Chaired Technical Sessions at various conferences and institutes both in India and abroad. Prof. Bakhshi has also been very actively involved in the organization of many national / international conferences, workshops and seminars. Prof. Bakhshi is presently member of the Editorial Board of the Indian Journal of Chemistry (Section A). He has also been the member of the editorial board of the Journal of Scientific and Industrial Research published by the CSIR and also the Chief-Editor of the UGC-sponsored journal Chemistry Education Review. He was also Co-guest Editor of the special

issue of the Indian Journal of Chemistry on Conducting Polymers.

Prof. Bakhshi has also been part of many Important Committees of National/International Importance. Director of the Institute of Lifelong Learning (ILLL) and the Centre for Professional Development in Higher Education (CPDHE). Prof. Bakhshi was felicitated by the Former President of India Dr. APJ Abdul Kalam for his contributions in the e-transformation of the University of Delhi, as Director ILLL. Prof. Bakhshi was also Member Scientist of the " Third Indian Research Expedition to Antarctica" in 1984.

**PROF. PRAMOD K. VERMA**

**President**

**Section of Earth System Sciences**

Prof. Pramod K. Verma born on January 7, 1961, obtained his B. Sc. Geology Hons. and M. Sc. Geology degrees from Ranchi University. He earned his M. Phil. Geology and Ph. D. degree from Vikram University, Ujjain and, Post-doc from Ruprecht-Karls University, Heidelberg (Germany). He has been recipient of several awards and fellowships viz. MPCST Young Scientist Award/ MPCST FTIYS Fellowship/German Academic Exchange Service (DAAD, Germany) Postdoc Fellowship/ SERC (DST) Visiting Fellowship/INSA Visiting Fellowship / GTZ (Germany) Special Award etc.

Prof. Dr. Pramod K Verma is currently Scientific Advisor to Government of Madhya Pradesh and Director General of Madhya Pradesh Council of Science & Technology. His responsibilities include advising Government of Madhya Pradesh on Science & Technology (S&T) related issues including applications of S&T in developmental programs/promoting and popularizing S&T amongst schools, colleges, universities including common public/developing S&T network and strengthening science communication skills / liaising with national and international funding agencies and, formulation and execution of R&D specific projects.

Dr. Verma has previously occupied various positions e.g. Director, Remote Sensing Applications Centre (MPCST, Bhopal) / Professor of Applied Geology, School of Studies in Earth Science, Vikram University, Ujjain/Nodal Officer, Association for Madhya Pradesh Inter-University Cooperation / Head, University Science Research Promotion Cell/ Director, University Information Centre/Advisor, University Computer Centre.

The significant research contributions of Dr. Verma include Tectonic Evolution of Great Boundary Fault of Rajasthan/Inversion Tectonics for Tectonic Evolution of Aravalli Mountain Range, Rajasthan /Applications of Anisotropy of Magnetic Susceptibility in tectonic investigations in Rhine Graben (Germany) / Applications of Remote Sensing data in neotectonic investigations in Aravalli Mountain Range, Rajasthan / Active Tectonic Manifestations of Madhya Pradesh Rivers. He has guided eight doctoral students and currently five students are working with him. He has more than 80 publications to his credit in national and international scientific volumes and has completed 53 sponsored research projects. His main fields of interest are Active Tectonics, Structural Geology, and Geoinformatics.

Dr. Verma is Vice President, Indian Society of Remote Sensing (Dehra Dun)/Vice President, Vigyan Bharati (Pune)/Executive Member, GEOCHANGE (London)/Executive Member, Indian

Geological Congress (Roorkee) in addition to Fellow/Life Member of several other professional organizations viz. AGU (Washington), ACID (Sao Paulo), IAGA (Boulder), IAHS (Birmingham), GSI (Bangalore), ISG (Ahmedabad), AEG (Hyderabad), SES (Lucknow), GGS (Nagpur). He is also Expert Member in several committees of Government of India e.g. Planning Commission, MoEF, CGWB, UGC, CSIR etc.

**PROF. H. R. VISHWAKARMA**

**President**

**Section of Engineering Sciences**

Prof. H.R. Vishwakarma, an alumnus GEC Jabalpur (B.E.) and IIT-Bombay (M.Tech.), has about 25 years of R&D and academic experience in ICT domain. He worked with ITI Limited, Bangalore (A Govt. of India Undertaking) for about 15 years and rose to the position of Dy. Chief Engineer (R&D). He founded research groups on Computer Networks, Multimedia & Information Systems and Convergent Technologies. He also coordinated initiatives such as Software Quality Assurance, Information Strategic Planning restructuring of R&D and formation of IT Business Group in ITI Limited. Subsequently, he served in Bangalore-based software industry for a few years (Senior PM of HCL Perot Systems, Engineering Director of Zygox Software) and as CTO at Indian Institute of Information Technology & Management, Trivandrum during the formative period of the institute. Currently, he is serving as Senior Professor at the School of Information Technology & Engineering, VIT University, Vellore, Tamil Nadu.

Soon after joining VIT in March 2004, Prof. Vishwakarma played a crucial role in unifying three erstwhile departments of IT, CS&E and Computer Applications into an integrated School of Computing Sciences. He provided strategic and administrative leadership to the School till November 2007 and contributed significantly towards innovation-led growth in every sphere of Computing/ICT education and research utilizing his vast R&D/industry/professional expertise and national/international connectivity.

Prof. Vishwakarma also formed and led the Software Engineering Division that offers a 5-year integrated MS-Software Engineering programme. He is also a founding member-investigator and departmental coordinator for TIFAC-CORE on Automotive Infotronics. Due to his efforts, VIT achieved the distinction of being the first Indian university to sign an agreement with the IEEE Computer Society for enhancing software education.

Prof. Vishwakarma is member of ACM, IEEE, Computer Society of India (CSI) and other professional societies. He is currently serving Honorary Secretary of CSI at National level for the term 2010-12. The other positions held by him in CSI include Chairman, Division-V (Education & Research) for the term 2007-09, National Student Coordinator for two terms (2006-07 & 2009-10) and the founder Chairman of CSI Vellore Chapter (28$^{th}$ February 2005 to 31$^{st}$ March 2006). He organized several national/international conferences. He launched a new series of CSI National Conferences on Education and Research (ConfER) held annually in different regions of India since 2007-08. He has been instrumental in enhancing CSI programmes and membership base across India and its international collaboration with IEEE, British Computer Society and Project Management Institute.

**PROF. B. K. TIWARI**

**President**

**Section of Environmental Sciences**

Dr. Brajesh Kumar Tiwari was born in the year 1954 in Faizabad (U.P.), He did his M. Sc. (Botany) from Gorakhpur University, Gorakhpur and Ph.D. from North-Eastern Hill University (NEHU), Shillong, India. He pursued his Post Doctoral research at the Institute of Arable Crop Research, Harpenden, Herts U.K. as a Rothamsted International Fellow. Presently, he is Professor and Head of the Department of Environmental Studies at North-Eastern Hill University (NEHU), Shillong, India. He is also in-charge of Regional Centre, National Afforestation and Eco-development Board (RCNAEB), Ministry of Environment and Forests (MoEF), Government of India, established at NEHU, in the capacity of its Coordinator.

Prof. Tiwari served as Dean, School of Human and Environmental Sciences NEHU from 2005-2009. He has published more than eighty research papers in peer reviewed journals and has authored and edited half a dozen books in the field of forestry, environment and natural resource management. He is known among his peers for his monumental works on Shifting Cultivation, Sacred Groves and Forest Management. His current research interests include: Ecorestoration of degraded lands, Community based Biodiversity Conservation, Ecosystem Health Assessment, Sacred Groves, Shifting Cultivation, Community and Joint Forest Management, Environmental Impact Assessment, Medicinal and Aromatic Plants, Gender issues in NRM, Climate Change Adaptation and Forest Products and Livelihoods. Dr. Tiwari has worked/collaborated with several national and international organizations viz., International Development Research Centre, South Asia Regional Office, New Delhi, Ford Foundation, New Delhi, Community Forestry International, Inc, USA, International Centre for Mountain Development, Kathmandu, International Fund for Agricultural Development, Rome, Mountain Institute, USA, Development Consultants Private Ltd., Kolkata, Centre for International Forestry Research, Bogor, Indonesia and University of Liverpool, U.K. on various research projects related to man-forest interface

In the capacity of Coordinator RC, NAEB, Prof. Tiwari closely interacts with Ministry of Environment and Forests, (MoEF) Government of India, New Delhi and Forest Departments of the seven states of north-eastern India. Dr. Tiwari has served as members of many national and state government committees and task forces. He was Chairman of State level Environmental Appraisal Committee, for the state of Meghalaya constituted by the Ministry of Environment and Forests Government of India, New Delhi under EPA Act 1986 during 2007-2010. Presently he is member of Meghalaya Protection of Catchment Areas Advisory Board, Government of Meghalaya, Shillong and he is empanelled expert for evaluation of Indira Priyadarshini Briksha Mitra Award of MoEF, Government of India. Dr. Tiwari has presented his research in a large number of international conferences and has organised several national and international conferences in his University. He is Fellow of National Institute of Ecology and life member of many professional societies and national institutes of India.

**DR. L. JOYPRAKASH SINGH**

**President**

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

Lairenlakpam Joyprakash Singh was born on October, 1976 at Thoubal, Manipur. Presently, he is the head of the Department, Electronics and Communication Engineering (ECE), North-Eastern Hill University (NEHU). He received his B.Tech. degree in Electronics and Communication Engineering from North-Eastern Regional Institute of Science and Technology (NERIST), Arunachal Pradesh in 1999. He completed his M.Tech. degree in Electronics Design and Technology from Tezpur University, Assam in 2000 and Ph.D. (Engineering) from Jadavpur University in May 2006. He joined as a Lecturer in the department of ECE, Sikkim Manipal Institute of Technology (SMIT), Sikkim in August 2001 and was promoted to Reader in May 2006. He then joined North-Eastern Hill University, Shillong as a Reader in July 2006 and became the first Head of the Department of ECE of the same University on rotation basis for a period of three years and established a full-fledged department with various laboratories during his tenure. His position was re-designated as Associate Professor in the same University in July 2009. He is now holding the second term of headship in the same department of the University.

Dr. L. Joyprakash Singh has organized workshops at National and International levels. He is coordinator of National MEMS Design Centre supported by the National Program on Micro and Smart Systems (NPMASS) at NEHU. He was local sectional secretary of 96$^{th}$ ISCA in ICT (including CS) and became sectional member of the same section. He has published various papers in reputed International Journals and Conferences.

**PROF. B. S. MURTY**

**President**

**Section of Materials Sciences**

Prof. B.S. Murty was born in Vijayawada in 1964. He started his career in Metallurgy with a Diploma (1983) in Government Polytechnic, Vijayawada and got his B.E. in Metallurgical Engineering from VRCE, Nagpur (1986). He obtained his M.E. (1988) and Ph.D. (1992) from I.I.Sc., Bangalore. He obtained Prof. A.A. Krishnan Gold Medal for the best M.E. thesis. He served Department of Metallurgical and Materials Engineering, IIT Kharagpur as a faculty member during 1992-2004 in various capacities from Visiting Lecturer to Professor. Since 2004, he is a Professor of the Department of Metallurgical and Materials Engineering, IIT Madras.

He is the recipient of Shanti Swarup Bhatnagar Award, a Fellow of ASM International, Fellow of Indian National Academy of Engineering, Fellow of Indian Academy of Sciences, Fellow of National Academy of Sciences and the recipient of Platinum Jubilee Award of ISCA, Distinguished Alumnus Award of VNIT Nagpur, Metallurgist of the Year

Award and Young Metallurgist Award of Ministry of Steel and Mines, MRSI Medal, INAE Young Engineer Award, INSA Young Scientist Award, ISCA Young Scientist Award. His fields of interest are nano materials and other advanced materials. He has authored about 300 publications. He is the Editor of Transactions of IIM and Key Reader to Metallurgical and Materials Transactions. He has supervised 23 Ph.D. (and 9 on going). He has filed ten patents and transferred one technology to a company.

Prof. B. S. Murty has pioneered the field of non-equilibrium processing by Mechanical Alloying (MA) since 1988 in India. He has not only developed novel materials over wide composition ranges in a variety of metallic systems using mechanical alloying, but also has made key contributions in the development of theoretical frame work in this field by developing milling maps and by proposing new mechanisms of alloying, developing thermodynamic concepts about phase fields in nanocrystalline state, amorphization, glass forming ability and nanoquasicrystal forming ability. He has recently developed a method of identifying the bulk metallic glass forming composition in multicomponent systems, with help of thermodynamic and topological modeling. His group has successfully developed nanocrystalline intermetallics and nanocomposites with exceptional strength levels. Al based nanocomposites developed by his group show incredibly high hardness levels of 13 GPa. NiAl-$Al_2O_3$ and FeAl- $Al_2O_3$ with high thermal stability and high strength (hardness as high as 9 GPa) have been developed. Cu based nanocomposites have been developed which can give very high strength (3 times that of OFHC Cu) without significant loss in electrical conductivity. His group has demonstrated that nanocrystalline W can be sintered at as low temperatures as 1500°C, while conventionally W is sintered at 2800°C. Nanocrystalline PZT with the highest ever reported dielectric constant of 35000 has been prepared by mechanical alloying. His group has developed magnetic nanocomposites with improved magnetic properties caused by exchange coupling between hard and soft magnetic phases. Multiferroic nanocomposites with very large magneto-electric coefficient have been developed by this group. He could also show significant improvement in the Cr recovery from Chromite ore (from 5% to 98%) by high energy ball milling. The group has successfully coated nanocrystalline magnesia on the refractory bricks of the ladle carrying liquid steel at 1600°C for improving their life. The group has also developed oxide dispersion strengthened ferritic and austenitic steels for possible high temperature applications. Prof. Murty demonstrated nanocrystallization of a number of Zr, Al, Fe and Mg based metallic glasses and the resultant improvement in the properties.

Prof. Murty and his group are the first in India to successfully develop a technology for the production Al-Ti-B master alloys for the grain refinement of Aluminium and its alloys. The efforts in his group have also lead to the development of Al-$TiB_2$ and Al-TiC *in-situ* composites with very good mechanical properties in comparison to conventional Al-SiC *ex-situ* composites. Very recently, he has proved that the grain refining submicron particles such as $TiB_2$ and TiC can be used to stabilize the Al foam during its e fabrication.

**PROF. ASHIS SENGUPTA**

**President**

**Section of Mathematics (including Statistics)**

Professor Ashis SenGupta was born in Kolkata in 1953 and is currently Professor of Applied Statistics Unit, Indian Statistical Institute, Kolkata. He studied B.Sc. (Hons) in Statistics at Presidency College and received M.Sc. from Calcutta University, S.D. from Indian Statistical Institute and Ph.D. from Ohio State University, USA, all in Statistics. He was a visiting faculty at Univ. of Missouri-Columbia, Stanford University, Univ. of Wisconsin-Madison, Univ. of California-Santa Barbara and Univ. of California-Riverside, USA. He has also been a visiting professor at several universities. He has guided seven (and three ongoing) Ph.D. scholars in India and USA, who are now faculty members at Universities in USA, UK, Korea and India. He has published many research papers in international journals of repute in a variety of areas including Multivariate Statistical analysis, Directional Data analysis, Bayesian inference, Environmental sciences, Reliability, etc. He is co-author of the book, Topics in Circular Statistics, World Scientific, USA, 2001, which has been adopted as a text book in many Universities worldwide, and is author of Probability Distributions for Directional Data, published by IMS, Brazil. He was an Editor of Multivariate Statistical Methods, as also of Statistical Paradigms, of Advances in Directional and Linear Statistics, Springer, USA, of Multivariate Statistical Methods with Recently Emerging Trends, McMillan India Ltd., and of special issues on Multivariate Statistical Inference, Directional Data Analysis, etc. of several international journals. He is Editor-in-Chief of Environmental and Ecological Sciences (Springer, USA) from 2011, Editor of Scientiae Mathematicae Japonicae (Japan), and Editorial Board member of many international journals and special volumes and Ex Editor-in-Chief of Journal of Indian Society for Probability and Statistics. He has developed the unique software, DDSTAP, for the analysis of Directional Data.

Prof. SenGupta has been invited as Chairman of Judge's Committee for International Awards in Statistics, inaugural Speaker, Guest of Honor, Chairman, Organizer, Plenary Speaker, Featured Speaker, & Resource person to many International Workshops and Conferences worldwide in all the five continents. He is winner of several International and National Awards and Grants. He was invited by People to People program (USA), Presidents of this program being Ex-Presidents of USA, to be a Citizen Ambassador in the Statistical Science Delegation of American Statistical Association to promote Statistics in China.

An Expert member in Advisory and Selection Committees and of Board of Research Studies of several Central and State Universities, he has also been member of several Working Groups of Central Statistical Organization, of Expert Committee for Ministry of Broadcasting, and of Standing Committees set up by Government of India. He is the Principal investigator of multi-crore rupees project on International Passenger Survey commissioned by Ministry of Tourism, Govt. of India, and is the Group Leader of International Statistical Analysis Group for JalaSRI, a multinational project sponsored by NSF (USA) and United Nations.

He is Advisor (2008-2010, 2010-2012 re-invited) in the Scientific Advisory Board of Institute of Statistical Mathematics, Japan. He has been Vice-President of International Forum for Interdisciplinary Mathematics and President of International Indian Statistical Association (India chap) successively for several terms. He was elected in 2010 as Fellow of the National Academy of Sciences, India. In 2009 he was elected a Fellow of the American Statistical Association—currently the only in-service statistician in India with this recognition.

**DR. MANJUSHREE RAY**

**President**

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

Dr. Manjushree Ray, M.B.B.S., M.D., (Anaesthesiology), M.A.M.S., born on 01st July 1956, is presently working as the Professor and Head of the Department of Anaesthesiology at Institute of Postgraduate Medical Education and Research, Kolkata. She has a teaching experience of 21 years and has been an examiner of D.A., M.D., and Ph.D.in various universities of India since 1998. In the year 1995, Dr. Ray received the Basudeb Guha Memorial Best Paper Award of Indian Society of Anaesthesiologist (West Bengal branch). She was elected as the President of prestigious national academic associations like Indian society for study of pain in (2007-2008), Indian Society of Anaesthsiology in 2009. She served Indian Society Aanaesthesiologist in various capacity including executive member, associate editor, vice president and president. As a member of an International body like SAARC Anaesthesiologist Association she delivered lectures in different countries of Asia. In 2010 Dr. Ray was invited as guest speaker at China in 14$^{th}$ World Pain Society Congress.

She has written two books of Anaesthesiology namely 'Anaesthesia for Undergraduates and Practitioners' and 'Update in Anaesthesia 1995' and contributed a few chapters in two text books of Anaesthesiololgy. Her publications contain 62 national and 3 international publications. She worked as a Guest Editor of the prestigious Journal of Indian Medical Association (May 1999) and Associate Editor of Indian Journal of Anaesthesia (1997-2000). She also edited the Indian Journal of Pain(1997-2003) and was a member of the Editorial Board of Bangladesh Journal of Anaesthesia (2004 -till date).

In various state and national conferences of Indian Society of Anaesthesiologists Dr. Ray delivered CME lectures in more than 30 occasions. It was her great pleasure to chair at least 50 scientific sessions of seminars and conferences of many cities of the country.

She loves to perform voluntary and social service by working as Major at General Hospital Territorial Army (GHTA) since 2001 and by training Paramedical Staff in Cardiopulmonary Resuscitation under St Johns Ambulance service and GHTA.

**PROF. (DR) UTTAM CHAND BANERJEE**

**President**

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

Uttam Chand Banerjee was born on 1st May 1956 in Birbhum district, West Bengal. He had his early education in Visva Bharati University, Santineketan and later on graduated from Jadavpur

University in Food Technology and Biochemical Engineering and did his post Graduation from the Department of Biochemical Engineering and Biotechnology, Indian Institute of Technology, Delhi in 1982. He obtained Ph.D. degree in Chemical Engineering and Technology from Panjab University, Chandigarh in 1991. He was a visiting Research Assistant Professor at the Industrial Biotechnology Centre, Department of Chemical Engineering, University of Waterloo, Canada with Prof. M. Moo Young. He worked as a scientist in the Institute of Microbial Technology, Chandigarh from 1984 to 2000. He then joined as Professor and Head, Department of Biotechnology in National Institute of Pharmaceutical Education and Research. Later on in the year 2003, he was appointed as the Head of the Pharmaceutical Technology Department in the same institute. He has more than 133 publications in the journals of International and National repute.

Dr. Banerjee basic research interest is the use of microbial technology for the production of pharmaceuticals. There are three major divisions of research in his laboratory. (1) Synthesis of enantiomerically pure drugs and drug intermediates. He has worked extensively on the use of various enzymes such as oxidoreductase, nitrilase, lipase, xanthine oxidase etc. for the enantiomeric resolution of chiral compounds to active drug intermediates. He has also developed and patented biotransformation process for the synthesis of various drug and drug intermediates (Duloxitine, ezetimibe, lubeluzole, diltiazem, mexilitine, metoprolol etc.). (2) Synthesis of nanoparticles and its application in pharmaceutical sciences. He is involved in the isolation, screening & characterization of metal nanoparticles producing novel microorganisms and their use in drug delivery system such as tagging of anticancer drugs to gold nanoparticles and (3) The production of probiotics through high cell density fermentation and to enhance the growth and therapeutic properties of various probiotics by optimizing various process parameters at small as well as at laboratory scale reactor.

He had guided 17 Ph.D. students and a number of M.Tech./M. Sc. students for their project work. He dealt a number of projects from various funding agencies and also he does many consultancies in the industries. In addition to this, he has twenty six patents and two industrial processes in his credit. He has won a number of awards and honours for his dedicated contribution in science and technology including Tata Innovation Fellowship for excellence in science from the Department of Biotechnology, New Delhi, Panjab Ratan Award, CSIR Shield award for Process Technology and CSIR technology prize for Biological Sciences and Technology. He received an award from USA for solving a food biotechnology problem. He is a member of many professional societies. He was the vice president of Biotech Research Society of India (BRSI) and also an executive member of Indian Association of Pharmaceutical Scientists and Technologists. He had visited many countries on collaborative programme/paper presentation etc.

**PROF. B. N. JAGATAP**

**President**

**Section of Physical Sciences**

Dr. B. N. Jagatap is Outstanding Scientist in the Department of Atomic Energy and heads the Atomic & Molecular Physics Division of Bhabha Atomic Research Centre (BARC), Mumbai. He is Senior Professor and Dean-Academic (Physical &

Mathematical Sciences) of Homi Bhabha National Institute, Mumbai, and Distinguished Professor (Adjunct) in the Department of Physics, Indian Institute of Technology Bombay, Mumbai. He is Editor of Indian Nuclear Society News.

Dr. Jagatap joined BARC Training School in 1976 after graduating from Bombay University. After successful completion of one year orientation course in nuclear science and technology in 1977, he started his research career in the field of lasers and their applications. Since then he is associated with various Atomic, Molecular and Optical Physics programmes of BARC. He obtained his Ph.D. in 1987 from Bombay University and then went on to do postdoctoral work in the University of Western Ontario, Canada. Later he worked as Visiting Scientist and then as Senior Visiting Fellow at the Centre of Chemical Physics of the University of Western Ontario. Over last thirty years, Dr Jagatap has worked in various areas of atomic, molecular and optical physics covering a wide spectrum of contemporary topics, i.e., quantum optics, laser spectroscopy, theoretical laser-atom/molecule interactions, coherent control, laser cooling and trapping of atoms, ultra-precision measurements and metrology, and accelerator based atomic and molecular physics. He has over 300 publications in reputed journals and conferences, 10 edited works, over 70 invited talks in national and international conferences, and over 30 colloquia and popular talks. He has guided 7 Ph.D. students so far.

Dr. Jagatap is a recipient of Homi Bhabha Award for Science & Technology in the year 1999 for his work in laser spectroscopy and physics. Other prominent honors include Senior Visiting Fellowship of Centre for Chemical Physics, Canada, Prof. Rai Dastidar Memorial Lecture Award and Platinum Jubilee Lecture Award of Indian Science Congress. Seven of his research papers have received best paper awards in various conferences. Currently he is President of Indian Society for Atomic & Molecular Physics.

**PROF. (DR.) PRAVIN CHANDRA TRIVEDI**
**President**
**Section of Plant Sciences**

Prof. (Dr.) Pravin Chandra Trivedi Vice-Chancellor, Deen Dayal Upadhyaya Gorakhpur University, Gorakhpur (U.P.), born in 1952 at Banswara (Rajasthan), obtained B.Sc. (1972), M.Sc. (1974), Ph.D. degree (1978) of the University of Rajasthan, Jaipur. He started his career as a Assistant Professor in Botany (1974) then became Associate Professor (1987) and Professor (2001) at the Department of Botany, University of Rajasthan, Jaipur. He proceeded to Department of Plant Pathology, North Carolina State University, Raleigh (U.S.A.) as a Post-Doctoral Fellow (1983-84) and worked with renowned Plant Nematologist Prof. K. R. Barker.

Professor Trivedi served as Head, Department of Botany and co-ordinator; P.G. Course in Biotechnology (2003-06); Director, College Development Council (2001-04); Vice-Principal, University Maharaja's College (2000-03) in the University of Rajasthan, Jaipur before joining his present assignment as Vice-Chancellor from January, 2011.

The research contribution of Professor Trivedi in the field of Plant pathology, Nematology,

Biological Control of Pest, Host-parasite relationship have earned him astounding fame throughout the entire academic world. Having 37 years of teaching and research experience at University level, Dr. Trivedi has published more than 250 research and review articles in Journals of repute and Guided 40 Ph.D. students for the Ph.D. degree. He has completed more than 21 Major Research Projects Dr. Trivedi visited several major research laboratories and his delivered invited talks in many countries.

Prof. Trivedi has authored 45 textbook and edited 89 university level books. He is the editorial board member of many National and International Journals. He is a life member of many scientific societies both at national and International level. He is an elected Fellow of many academic societies viz. Fellow of Linnean Society, London; Indian Phytopathology Society; Indian Botanical Society; Indian Nematological Society; Ethnobotanical Society; Mendelian Association; Bioved Research Society; International Society for conservation of Natural Resources; Indian Association of Angiosperm Taxonomy.

Prof Trivedi served many academic bodies in different capacities viz. Secretary, Indian Botanical Society (2005-2010); President, International Society for conservation of Natural resources (2010-11); Vice-President, Mendelian Association (2009 onwards); President, Indian Phytopathology Society, Central Zone (1997 & 2003); Convener, Jaipur Chapter, Indian Science Congress Association, Kolkata (1999-2007); Councillor, Nematological Society of India (1995-97); Councillor, Indian Botanical Society (1998-2001); President, Society for promotion of Plant Science Research (2005-06); Council member, Indian Science Congress Association, Kolkata (2003-05, 2007-09). Prof. Trivedi has organized 20 National level seminars and participated in large number of conferences in India and abroad & Chaired sessions.

In recognition of his scientific contributions, he received a large number of awards and honours. To mention a few are : Scientist of the year Award; M. J. Narsimhan Award; Bioved Fellowship Award; Birbal Sahni Foundation Honor; Rashtriya Gaurav Samman; Bharat Shiksha Ratna Award; Distinction Award for Books in life Science; Shiksha Vibhushan Award; Life Time Achievement Award.

# Conferences / Meetings / Symposia / Seminars

**National Conference on Interface of Science and Environment : Emerging Public Health Challenges, November 24–26, 2011, Kolkata**

**Theme : Good Environment : Good Health**

**Suggested sub-themes :**

- Alternative sources of energy
- Antimicrobial resistance
- Ayurveda—the eco-friendly, holistic therapeutics
- Bio-ethics and management
- Bioterrorism
- Climate changes and impact on health
- Ecosystem and microbes
- Effects of chemicals (pesticides etc.) on argiculture
- Emergence of microbial drug resistance
- Environmental implications of nanotechnology
- Environmental planning and management
- Environmental factors affecting human body and mind
- Environmental pollution and impact of life
- Flora & fauna and human existence
- Geology and human health issues
- Heavy metals and human health
- Medicines from the nature
- Misuse of medicines and health hazards
- Natural calamity and disaster management
- Occupational health
- Radiation hazards
- Venoms and toxins
- Veterinary health and environment
- Waste recycling and management
- Wild life conservation

**Conference Secretariat :** Department of Laboratory Medicine, Calcutta School of Tropical Medicine (CSTM), 108, C. R. Avenue, Kolkata - 700 073, Mobile : 09831386832 Email : scienviron2011@gmail.com cellmolim@gmail.com.

**2nd Nano Today Conference, December 11–15, 2011, Waikoloa Beach, Marriot Resort Waikoloa - Hawaii, USA**

**Conference Topics :**

- Synthesis and Self-Assembly of Nanocrystals and Nanoparticles
- Synthesis and Self-Assembly of Thin Films
- Functionalization and Size-Dependent Properties of Nanocrystals, Quantum Dots and Nanowires
- Processing and Templating of Nanotubes and Nanoporous Materials

- Tailoring and Polymeric Nanoparticles, Organic-Inorganic Nanocomposites and Biohybrids
- Nanosystems for Biological and Medical Applications
- Nanodevices for Sensing, Diagnostic, Imaging, Magnetic and Electronic Applications
- Nanomaterials for Chemical and Catalytic Applications
- Nanomaterials for Energy and Environment Applications

**Conference Chair :** Prof. Jackie Y. Ying, Editor-in-Chief, Nano Today, Executive Director, Institute of Bioengineering and Nanotechnology, Singapore. Visit www.nanotoday-conference.com

**M4D2012 3rd International Conference on Mobile Communication for Development 28–29 February, 2012, New Delhi, India.**

**Subtheme :**

- Social implications of mobile communications
- Mobile health
- Mobile communication and political participation/change
- Agriculture, rural development and mobile communication
- Economic development and mobile communication such as mobile banking and mobile money
- Mobile learning
- Mobile communication and community awareness/development
- Mobile communication and disaster management
- Mobile communication and corruption fighting
- Mobile communication and election/government monitoring
- Mobile communication and climate control
- Challenges to the proliferation of mobile technology
- Mobile communication and women empowerment
- Mobile communication and surveillance
- Innovative applications for mobile communication

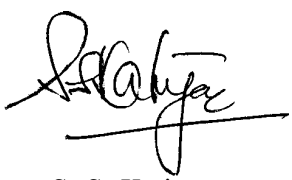
**Contacts :** Dr. Vikash Kumar, Professor–IT, Institute of Management Studies (IMS), C–238 Lal Quan, Bulandshahar Road, Ghaziabad–201009 (UP) India, Phone : (91 120) 4170629, 4170600, Fax : (91 120) 2866034, Email : m4d2012@gmail.com, Web : www.m4d2012.com.

## FORM IV

**Rule 8**

| | | |
|---|---|---|
| 1. | Place of Publication | The Indian Science Congress Association<br>14, Dr. Biresh Guha Street,<br>Kolkata 700 017 |
| 2. | Periodicity of Publication | Bi-monthly (Published every two months) |
| 3. | Printer's Name<br>Nationality<br>Address | Prof. S. S. Katiyar<br>Indian<br>The Indian Science Congress<br>14, Dr. Biresh Guha Street,<br>Kolkata-700 017 |
| 4. | Publisher's Name<br>Nationality<br>Address | Prof. S. S. Katiyar<br>Indian<br>The Indian Science Congress Association<br>14, Dr. Biresh Guha Street,<br>Kolkata-700 017 |
| 5. | Editor-in-Chief's Name<br>Nationality<br>Address | Prof. S. S. Katiyar<br>Indian<br>7/111-E Swaroop Nagar<br>Kanpur - 208002<br>Uttar Pradesh |
| 6. | Name and Address of individuals who own the newspaper and partners of Shareholders holding more than one percent of the total | The Indian Science Congress Association<br>14, Dr. Biresh Guha Street,<br>Kolkata-700 017 |

I, S. S. Katiyar, hereby declare that the particulars given above are true to the best of my knowledge and belief.



Date : 31 May 2011

S. S. Katiyar
Publisher
Everyman's Science

# S & T ACROSS THE WORLD

## SMART SKIN: ELECTRONICS THAT STICK AND STRETCH LIKE A TEMPORARY TATTOO

An ultrathin, electronic patch with the mechanics of skin, applied to the wrist for EMG and other measurements. Engineers have developed a device platform that combines electronic components for sensing, medical diagnostics, communications and human-machine interfaces, all on an ultrathin skin-like patch that mounts directly onto the skin with the ease, flexibility and comfort of a temporary tattoo.

Led by researcher John A. Rogers, the Lee J. Flory-Founder professor of engineering at the University of Illinois, the researchers described their novel skin-mounted electronics in the Aug. 12 issue of the journal *Science.*

The circuit bends, wrinkles, and stretches with the mechanical properties of skin. The researchers demonstrated their concept through a diverse array of electronic components mounted on a thin, rubbery substrate, including sensors, LEDs, transistors, radio frequency capacitors, wireless antennas, and conductive coils and solar cells for power.

"We threw everything in our bag of tricks onto that platform, and then added a few other new ideas on top of those, to show that we could make it work," said Rogers, a professor of materials science and engineering, of chemistry, of mechanical science and engineering, of bioengineering and of electrical and computer engineering. He also is affiliated with the Beckman Institute for Advanced Science and Technology, and with the Frederick Seitz Materials Research Laboratory at U. of I.

A new form of electronics, small enough to fit under a temporary tattoo, changes the way scientists think about gathering data from the human body. Credit: University of Illinois

The patches are initially mounted on a thin sheet of water-soluble plastic, then laminated to the skin with water -just like applying a temporary tattoo. Alternately, the electronic components can be applied directly to a temporary tattoo itself, providing concealment for the electronics.

"We think this could be an important conceptual advance in wearable electronics, to achieve something that is almost unnoticeable to the wearer," said U. of I. electrical and computer engineering professor Todd Coleman, who co-led the multi-disciplinary team. "The technology can connect you to the physical world and the cyberworld in a very natural way that feels very comfortable."

Skin-mounted electronics have many biomedical applications, including EEG and EMG sensors to monitor nerve and muscle activity.

One major advantage of skin-like circuits is that they don't require conductive gel, tape, skin-penetrating pins' or bulky wires, which can be uncomfortable for the user and limit coupling efficiency. They are much more comfortable and less cumbersome than traditional electrodes and give the wearers complete freedom of movement.

"If we want to understand brain function in a natural environment, that's completely incompatible with EEG studies in a laboratory," said Coleman, now a professor at the University of California at San Diego. "The best way to do this is to record neural signals in natural settings, with devices that are invisible to the user."

Monitoring in a natural environment during normal activity is especially beneficial for continuous monitoring of health and wellness, cognitive state or behavioral patterns during sleep.

In addition to gathering data, skin-mounted electronics could provide the wearers with added

capabilities. For example, patients with muscular or neurological disorders, such as ALS, could use them to communicate or to interface with computers. The researchers found that, when applied to the skin of the throat, the sensors could distinguish muscle movement for simple speech. The researchers have even used the electronic patches to control a video game, demonstrating the potential for human-computer interfacing.

The circuits' filamentary serpentine shape allows them to bend, twist, scrunch and stretch while maintaining functionality.

Rogers' group is well known for its innovative stretchable, flexible devices, but creating devices that could comfortably contort with the skin required a new fabrication paradigm.

"Our previous stretchable electronic devices are not well-matched to the mechanophysiology of the skin," Rogers said. "In particular, the skin is extremely soft, by comparison, and its surface can be rough, with significant microscopic texture. These features demanded different kinds of approaches and design principles."

Rogers collaborated with Northwestern University engineering professor Yonggang Huang and his group to tackle the difficult mechanics and materials questions. The team developed a device geometry they call filamentary serpentine, in which the circuits for the various devices are fabricated as tiny, squiggled wires. When mounted on thin, soft rubber sheets, the wavy, snakelike shape allows them to bend, twist, scrunch and stretch while maintaining functionality.

"The blurring of electronics and biology is really the key point here," Huang said. "All established forms of electronics are hard, rigid. Biology is soft, elastic. It's two different worlds. This is a way to truly integrate them."

## SCIENTISTS DISCOVER HOW MOLECULAR MOTORS GO INTO 'ENERGY SAVE MODE'

Structural rendering of kinesin's two heads, called motor domains, cross-linked by a bound tail domain (green). Credit: Carnegie Mellon University A new study from Carnegie Mellon University and the Beatson Institute for Cancer Research published in the Aug. 12 issue *of Science* describes how the motors fold in on themselves, or save energy, when their transport services aren't required. According to the researchers, the solution to this molecular puzzle provides new insight into how molecular motor proteins are regulated, and may open new avenues for the treatment of various neurodegenerative diseases, such as Alzheimer's and Huntington's.

"Molecular motor proteins play a major role in all eukaryotic cells, but they are particularly critical to nerve cells," said David Hackney, professor of biological sciences in the Mellon College-of Science, and one of the paper's authors. "Nerve cells-have this special problem where proteins, such as receptors for neurotransmitters, get synthesized in the cell body and have to be shipped all the way down the axon. Problems in this transport system may play a role in a number of neurological conditions."

Hackney focuses his research on kinesin-1, the principle motor protein that moves cargo from the nerve cell body down the axon. A typical kinesin molecule has two tails on one end that attach to the cargo and two globular heads on the other end that crank along fibers inside the cell called microtubules, pulling the cargo forward. The movement of the heads, or motor domains, is fueled by the breakdown of ATP, a molecule that stores the energy that drives cellular work. When cargo isn't attached, kinesin folds in upon itself to prevent ATP from being squandered. Although scientists knew that one tail binds to the two heads to keep it in a folded "autoinhibited" state, the molecular mechanism remains unclear. Several

possibilities have been proposed, but these latest findings suggest only one solution.

Hackney worked with Hung Yi Kristal Kaan and Frank Kozielski at the Beatson Institute for Cancer Research in Glasgow, Scotland, who crystallized a key portion of the kinesin molecule—a tail that was bound to the heads. The crystal structure confirmed that the complex contained two head domains and only one tail domain. Hackney then carried out biochemical manipulations to determine precisely how the tail interacts with the heads, which turned out to be what the authors refer to as a "double lockdown."

"It was actually a big surprise," Hackney said, "because it ruled out all of the obvious things that had been proposed for how the tail domain autoinhibits the motor domain. It does not cause a conformational change, and it does not block the surfaces that interact with ATP or the microtubular track."

Kinesin's heads are typically joined together at one spot, called the hinge. In the new structure, the heads swing in toward each other and are bridged by the tail domain, effectively cross-linking the heads at the site of tail binding. This double lockdown–at the hinge and at the bridge–prevents the heads from separating. Because the heads need to be separate from each other to break down ATP, the double lockdown effectively stops the molecule from generating fuel to power the motor.

The researchers suggest that other kinesins may be regulated by the same autoinhibitory mechanism. Humans have dozens of different kinesin motors that transport a variety of cargo, including proteins associated with Alzheimer's, Huntington's and Parkinson's diseases. Kinesins are also involved in separating chromosomes during cell division, making the motors a target for cancer therapies that seek to stop the motors from transporting chromosomes, which would prevent cancer cells from multiplying.

Provided by Carnegie Mellon University (news : web)

## INDIGENOUS ARMOURED TRACKED VEHICLES

Combat vehicles play an important role for any Army during the war as well as for post-war operations. Their applications have always been integral for a wide range of operations from high-intensity combat to peacekeeping. Defence Research and Development Organisation (DRDO) is engaged in design and development of armoured fighting vehicles (AFVs) to enhance combat capabilities of the Indian Army. The tracked vehicles developed by DRDO, viz. Arjun Main Battle Tank (MBT), Combat proved Ajeya (CIA), Carrier Mortar Tracked (CMT), Bridge Layer Tank (BLT) T-72, Armoured Ambulance are the remarkable achievements, which have been productionised and are inducted into the Services. Arjun MBT has excelled in its performance and over that its systems are at par with the world-class contemporary tanks. With the experience gained during the development of Arjun MBT and modernisation of Ajeya, DRDO has designed and developed the variants like Ex-Tank and Bhim. The Carrier Command Post Tracked (CCPT) on BMP-II received acclaim from various Directorates of the Indian Army and is likely to be inducted to the Services soon. Design and development of Arjun MBT Mk II and Unmanned Ground Tracked Vehicles (UGVs) for mine detection, surveillance, and Nuclear Biological Chemical (NBC) air in the pipeline.

## ARJUN MAIN BATTLE TANK

Arjun MBT, designed to Indian Army's most stringent specifications, represents the translation of advanced design into a reliable and effective weapon system to meet the varied threats of the modern warfare. If offers the troops a state-of-the-art

tank with superior fire power, high mobility, and excellent protection by adopting most advanced technologies. Army has placed an indent for production of 124 Arjun MBT Mk I to Heavy Vehicles Factory. Avadi, Chennai. More than 100 Arjun MBTs have been delivered to the Army. Indent for production of 124 Arjun MBTs Mk II is likely to be palced shortly. The salient features of the Arjun systems are :

| | |
|---|---|
| Length of the track of ground | : 4400 mm |
| Ground clearance | : 400-445 mm |

**Speed of Movement**

| | |
|---|---|
| Average speed | |
| - On a dirty road | : 35-45 km/h |
| - On a highway | : Up to 50 km/h |
| Max. speed on highway | : 60 km/h |

**Cross-country Performance**

| | |
|---|---|
| Maximum grade ascending ability | : 30 |
| Maximum trench crossing width | : 2.6–2.8 m |
| Vehicle obstacle ability | : 0.85 m |