

## 100<sup>th</sup> INDIAN SCIENCE CONGRESS HELD AT KOLKATA

JAN 3- 7, 2013,

The 100<sup>th</sup> Indian Science Congress was held at Kolkata under the auspices of Calcutta University, from January 3<sup>rd</sup> to 7<sup>th</sup>, 2013. **Hon`ble Sri Pranab Mukherjee, President of India inaugurated the Congress on 3<sup>rd</sup> January at Yuva Bharati Stadium and Dr.Manmohan Singh, Hon`ble Prime Minister of India and General President presided over the function.**

His Excellency Governor of West Bengal Shri M K Narayanan gave the welcome speech. Hon'ble Union Minister of Science and Technology and Earth Sciences, Government of India, Shri S Jaipal Reddy and Hon'ble Chief Minister of West Bengal Ms Mamata Banerjee addressed the august gathering. The Science,Technology and Innovation Policy 2013 was released. Dr.Manmohan Singh, Hon`ble Prime Minister of India, and General President released the proceedings of 100<sup>th</sup> Indian Science Congress. A book entitled `Balancing Act` was released by Hon'ble Chief Minister of West Bengal Ms Mamata Banerjee. The report of nation wide celebration was released by Hon'ble Union Minister of Science and Technology and Earth Sciences, Government of India, Shri S Jaipal Reddy. On this occasion the postage stamp to commomerate centenary session of Indian Science Congress Association was also released. Prof Geetha Bali, Immediate past President , Prof R C Sobti, General President Elect, Dr T Ramasami, Secretary DST , Dr. Vijay Laxmi Saxena, General Secretary (Scientific Affairs), and Dr. Manoj Kumar Chakraborti, General Secretary (Membership Affairs) were also present. . Hon`ble Prime Minister of India, Dr. Manmohan Singh, delivered his Presidential address on the Focal Theme “Science for Shaping the Future of India” and Hon`ble Sri Pranab Mukherjee, President of India delivered his Address and presented ISCA Awards to a number of eminent scientists from the country and abroad for their outstanding scientific contributions. Prof. Suranjan Das ,Vice Chancellor, Calcutta University delivered the Vote of Thanks. Over 18,000 registered delegates, participated in the 100<sup>th</sup> science congress including a large number of scientists from different parts of the world.

Immediately after the inauguration a Theme panel was organized on the Focal theme “Science for Shaping the Future of India” where Dr.Manmohan Singh, Hon`ble Prime Minister of India and General President Chaired the session. The speakers were Dr R Chidambaram,DAE Homi

Bhabha Chair Professor & Scientific Adviser, GOI, Prof M S Swaminathan, Emeritus Chairman, MS Swaminathan Research Foundation and Dr John Beddington, Chief Scientific adviser, Govt of UK .

**On 4<sup>th</sup> January, 2012, His Excellency, Dr. A.P.J. Abdul Kalam, Former President of India inaugurated the Children's science congress** at Satyendra Nath Bose National Centre for Basic Sciences in the presence of His Excellency Governor of West Bengal Shri M K Narayana, Hon'ble Union Minister of Science and Technology and Earth Sciences, Government of India, Shri S Jaipal Reddy, Secretary DST, Govt of India, Dr T Ramasami. INFOSYS – ISCA Travel Awards to school students were presented on this occasion by Dr A P J Abdul Kalam. The “Science for School Children” which was organized with support from NCSTC, DST was a highly successful programme. Following the inauguration of the Children's Science congress, Dr. Kalam inaugurated the children's Science Exhibition where children from 125 selected institutions displayed their prize winning

For the second time in the history of Indian Science Congress, a Women's Science Congress was organized on 5<sup>th</sup> January 2012 on the theme “**Women Empowerment for the development of country**” . This programme that motivated participation of a large number of women in science congress, was inaugurated by Hon'ble Union Minister of Science and Technology and Earth Sciences, Government of India, Shri S Jaipal Reddy in Satyendra Nath Bose National Centre for Basic Sciences. Dr Gretchen Kalonji, Assistant Director General for Natural Science, UNESCO, Paris delivered her Address. Prof Suranjan Das, Vice Chancellore , Calcutta University and Dr Vijay Laxmi Saxena, General Secretary (Scientific Activities) , ISCA were present.

Following the inauguration of Science congress on 3<sup>rd</sup> January, Hon'ble Union Minister of Science and Technology and Earth Sciences, Government of India, Shri S Jaipal Reddy inaugurated the **Science Exhibition**. in the presence of other dignitaries. *Special Pavilions* at PoI Expo were “**Hall of Pride**” (HoP), designed to raise a toast to the life and works of **Pt. Jawaharlal Nehru** - The first Prime Minister of India and also the General President of Indian Science Congress; **Hon'ble Justice Sir Asutosh Mookerjee** - A prolific Bengali educator and the first Indian Vice Chancellor of the University of Calcutta and also the first General President (GP) of Indian Science Congress Association (ISCA); “**Edu Vision**” brought various educational institutions under one roof & other stake holders in education sector; “**International Pavilion**”

hosted stalls of different countries showcasing their respective joint R&D/S&T ventures with India.

Besides, **Vigyan Sancharak Sammelan** was organised with support from NCSTC, DST, New Delhi, where science communicators selected from different chapters of ISCA participated. The two-day National science film festival,

There were plenary sessions on topics of importance especially in the context of India's achieving inclusive development. There were symposia and panel discussions and public lectures and special lectures from eminent scientists, technocrats, policy makers from India and abroad as well as representatives from industries, addressing current issues and the main focal theme from different perspectives as well as latest developments in S & T. The 100<sup>th</sup> ISC witnessed vibrant sectional activities in all the 14 sections. Keeping up the past tradition, symposia on different interesting topics complementary to the main focal theme were organised in the 14 sections besides the Platinum Jubilee Lectures in each section. Invited Lectures and Paper Presentations (through Posters/Oral) organised in different sections were highly applauded. **Endowment lectures** constituted a vital part of the programme. This apart, public lectures by Nobel Laureates and few award lectures were organized in respective sections.

The **Valedictory Session** was held on January 7<sup>th</sup>, 2013. Dr Vijay Laxmi Saxena, General Secretary (Scientific Activities), ISCA, delivered the welcome address. Prof M S Swaminathan graced the occasion as chief guest. His Excellency Governor of West Bengal Shri M K Narayanan presided over the function. Among others, Prof Suranjan Das, Vice Chancellor, Calcutta University, Dr T Ramasami, Secretary DST, Prof R C Sobti, General President Elect, Dr. Manoj Kumar Chakraborti, General Secretary (Membership Affairs), were present on the occasion. Shri M K Narayanan, H.E. the Governor of West Bengal presented awards and certificates to the winners of the ISCA Young Scientists' Awards and Best Poster awards from each of the 14 sections and also to representatives of institutions for outstanding participation in the exhibition.

## **Inaugural Speech by the President of India, Shri Pranab Mukherjee at the inauguration of 100th Session of Indian Science Congress**

Dr Manmohan Singh, Honourable Prime Minister of India and the General President of Indian Science Congress Association, Shri Narayanan, Excellency the Governor of West Bengal, Miss Mamata Banerjee, Hon`ble Chief Minister of West Bengal, Shri Jaipal Reddy, Hon`ble Minister of Science and Technology and Earth Sciences, Government of India, Past General President and President elect and General Secretaries, Members of the Council and Executive Committee of Indian Science Congress Association, Science Icons of the World including Nobel and Abel Prize Awardees, distinguished friends and representatives of the press and media.

At the outset, I wish the participants to the Centenary session of Indian Science Congress and the people of the Nation, a purposeful and productive New Year. My warmest congratulations to the Indian Science Congress on the occasion of the celebration of their centenary. The Prime Minister of India generally inaugurates the annual sessions of Indian Science Congress. In the current year, the Association has elected the Prime Minister as its General President. I congratulate Dr. Manmohan Singh for being elected as the General President of Indian Science Congress in this historic year. It is a befitting honour. I can from personal experience vouchsafe the abiding faith of Dr. Manmohan Singh on education, science and technology. The good performance of science and technology sector in the recent years, I believe, owes greatly to the generous government support for S&T catalysed by the Prime Minister.

I am an alumnus of Calcutta University. Naturally, I am delighted to participate in a function co-organized by Calcutta University. As an alumnus, I fondly remember defining role of this university and Sir Asutosh Mukherjee in nurturing the Indian Science Congress in the early years. Kolkata has remained historically a city of culture, of knowledge. All Nobel Prizes awarded for work from India are somehow linked to the city of Kolkata. Sir Ronald Ross carried out his pioneering research on Malaria in this city for which he was awarded the Nobel Prize in 1902. Sir CV Raman's remarkable discovery, the Raman Effect, for which he was awarded the Nobel Prize in Physics in 1930, was made here in Kolkata. The legendary Rabindranath Tagore and Mother Teresa were also awarded Noble Prizes for their work carried out in Kolkata. The earliest organizations associated with science—The Asiatic Society, The Indian Association for the Cultivation of Science and the Indian Science Congress Association were established here. These organizations gave rise to celebrated luminaries in science who promoted a scientific culture. Sir JC Bose, Prof. Satyendra Nath Bose, PC Ray, Meghnad Saha and many others who built the edifice of modern science in the country. Sir JC Bose is hailed as the first of modern scientists of this country. His original contributions to the invention of radio are well known. The recent discovery of Higgs-boson particle highlights the epoch making contributions of Prof. Satyendra Nath Bose to particle physics. I do hope that the modern scientists of this city would emulate the examples of these leaders of science of the past.

ISCA presented me a compilation of all the addresses of General Presidents of the Association as well as the inaugural addresses delivered over the years. These make fascinating reading. In a sense, these capture the history of Indian science as it evolved over the past 100 years. In the year 1957, I was a student at Calcutta University. In that year, the Prime Minister of India Pandit

Nehru was the Chief Guest. The Chief Minister of Bengal, the visionary Prof BC Roy was the President of the Science Congress. The topic of BC Roy's address to the Congress was "On Science for Human Welfare and Development of Country". The topic then was akin to the theme of the present session - "Science for Shaping Future of India". I was greatly touched by BC Roy's concluding message and I quote: "The clouds of time may have hidden for us innumerable problems, trials and dangers, yet time may also reveal solutions of unknown difficulties or delightful surprises which man with his knowledge of Science should be prepared to turn to his advantage with faith, hope and good will."

Let me congratulate the Indian Science Congress for selecting "Science for Shaping Future of India" as the focal theme for its 100th Session. Science has to be closely linked to a culture within the society which is built on scientific knowledge. It calls for a scientific temper that Pt. Nehru always used to talk about. Scientific culture demands that choices and decisions are made by individuals, society and the nation on the basis of scientific logic. Indian economy has been following a new paradigm of development; faster, sustainable and inclusive growth with equity. It is a new concept because it combines the faster growth with objectives of inclusiveness and sustainability. How to harness the forces of science, technology and innovation to achieve this end calls for deep deliberation. I am sure, you will discuss this in all its aspects and implications with the seriousness that it demands.

Science is one of the creative endeavours of human mind. Pursuit of Science as a personal passion can not be regulated or directed when the thrill of pursuit is in "Knowing the truth of Nature". Prepared and creative minds are required to observe the revelations of Nature. Science seeks universal and fundamental truth. Culture of Excellence is the second nature of creative scientists. Eminent scientists of the world have always been concerned as to how their understanding of natural phenomena could be applied to solve social problems of the future. Sir JC Bose, more than a century ago, on 5th March 1885, wrote in his diary "I have been thinking whether the solar energy that is wasted in tropical regions in a new way could be utilized. Of course trees conserve the solar energy. But is there no other way of directly utilizing the radiant energy of the sun?" The seed for artificial photosynthesis was sown then. Even now it is an active area of research pursuit globally. His disciple Prof. Satyendra Nath Bose was a powerful communicator and an inspired teacher. He delivered lectures on 'power' and 'nuclear energy' in a language that lay people could understand. He motivated generation of people to move towards scientific endeavour. Public and political understanding of science is crucial. For that, I would like to urge upon you all to apply modern tools for communicating science in a manner that can be understood by the common man. This understanding would contribute to the creation of a science culture in the Indian society.

The prime concern of any government in a country is enhancing the well being of its people. Technology has the power of changing the lives of the people by creating physical well being. Countries have undergone transformational changes, all in one generation, from a relatively weak to an emerging economy. In this transformational change, technology-led economic growth has played a key role. While technology can be considered a logical extension of knowledge gained from science, it is much more than mere application of science. Technology is contextual. There is a economic value to technology. We all are a witness to the transformational changes being brought about by mobile telephony and internet. The number of mobile phone users in

India was around 19 crore in October 2012 which is the second highest in the world after China. The mobile phone density of 74.21 per cent of India compares favourably with the other top ranking countries. Another marvel of technology—the internet—has become a vital source of information and communication. India ranks third after China and USA in terms of number of internet users. However, the penetration of internet use as the percentage of the population is only 11.4 indicating the huge potential for future growth.

Another transformational application of technology is Aadhaar project which focuses on electronic transfer of benefits directly to the beneficiaries of various social sector schemes. I understand the roll out of Aadhaar enabled service delivery has already started in twenty districts. In the Budget 2012-13, a target for covering fifty districts has been set which, I am sure, will be met.

It is essential to innovate if we have to compete in a globalised economy. India has declared 2010-20 as the decade of innovation. The announcement of Science, Technology and Innovation Policy today lays the roadmap for the development of an eco system for innovations and for encouraging, recognizing and rewarding the innovators in the society, especially the grass root innovators who through their genius are adding value to the processes which directly impact the local population.

The new STI policy has also addressed the issue of right-sizing our research and development system. Balanced economic growth especially in emerging economies like India is of paramount importance. Productive engagement of our youth in agriculture, manufacturing and value based services holds the key for a balanced growth of the country. The new STI Policy, I am confident, will pave the technology-led path for change ensuring prosperity with peace and inclusiveness.

We need an educational system which lays importance on development of a scientific culture within the society. Mere economic growth without the attendant knowledge capacity to manage the dimensions of change would neither suffice nor be appropriate.

Our ancient universities, whether these be Nalanda or Taxila, focused on value based holistic education. Perhaps it is appropriate to quote from an address of Rabindranath Tagore delivered ninety years ago : “You know the traditions of our country are never to accept any material fees from the students in return for teaching, because we consider in India that one who has knowledge has the responsibility to impart it to the students”. Swami Vivekananda always spoke of fusion of cultural values of the orient with practical methods of the occident. Innovation is a modern means of converting knowledge into social value and wealth. Indian philosophy, seeks to balance the pursuit of wealth and material success with the mastery of the self and the quest of inner happiness. The deeply introspective, yet practical, wisdom of Indian philosophy must find resonance in the metaphor of competition and conquest popularized in the modern world.

I conclude with a quote from Swami Vivekananda, he said: "No nation can be said to have become civilized, only because it has succeeded in increasing the comforts of material life by bringing into use lots of machinery and things of that sort. ... In this age as on the one hand people have to be intensely practical, so on the other, they have to acquire deep spiritual knowledge".

I would like to call upon the scientific community to work for the promotion of a scientific culture for shaping our future in which prosperity and peace, excellence and equity and oriental values and occidental methods of science converge and co-exist. India is expected to emerge as a major economic power by 2035. We should also emerge as a major knowledge power with high human and societal values. Let me mention in this regard that it has been 83 long years since CV Raman won the Nobel Prize for Physics. Another Nobel Prize in the sciences is long overdue for India. I call upon scientific fraternity gathered here to rise upto this challenge and work towards this goal in a time bound manner.

With these words, I formally inaugurate the 100th session of Indian Science Congress.

Thank you.

Jai Hind!

**Presidential Address by Dr. Manmohan Singh at the 100th Indian Science Congress**

The Prime Minister, Dr. Manmohan Singh, addressed the Indian Science Congress, in Kolkata today. Following is the text of the Prime Minister's address on this occasion:

"As General President of the Indian Science Congress Association, it is my great honour to welcome our Chief Guest, the Hon'ble President of India, Shri Pranab Mukherjee. Our President is a distinguished statesman. His wisdom, knowledge and vast experience of public life are great national assets. I also welcome the galaxy of luminaries, practitioners, policymakers and worshippers of science who have come together today to celebrate the centenary of the Indian Science Congress.

By selecting Kolkata as the venue of this historic occasion, the Congress is celebrating its 100th Anniversary at the original home of the Association. Modern Indian science was largely nurtured here in the soil of Bengal. Kolkata's credentials in science are burnished not only by the impressive list of institutions it hosts today, but by the inquisitiveness, creativity and liberalism that have defined its residents for many generations. I thank the Government of West Bengal, particularly the Governor, Shri Narayanan, the Chief Minister, Kumari Mamata Banerjee, and the people of Kolkata for their unstinting support to the Science Congress.

I would also like to take this opportunity to felicitate the Executive Committee and Members of the Council of the Indian Science Congress Association for their work during the year and for achieving many of the initiatives I had outlined in my inception address in this very city seven months ago.

On the centenary of the Association, let us pause for a minute to recall the foresight and determination of its founding fathers – Sir Ashutosh Mukherjee, Professor J. L. Simonsen and Professor P.S. MacMahon. We also salute the genius and dedication of other stalwarts like Acharya Prafulla Chandra Ray, Sir RN Mookerjee, Sir Jagdish Chandra Bose, Sir M Visvesvaraya, Sir CV Raman, Sir SN Bose and Professor Meghnad Saha, who made this great institution a vehicle for the spread of knowledge and progress for the Indian nation. Let their commitment and social consciousness be the guiding spirit of today's scientists.

The theme of this Congress, 'Science for Shaping the Future of India', reflects the dream of every generation of Indian scientists. Faster growth over the next few decades, more sustainable development based on food and energy security, and socio-economic inclusion made possible by rapid growth of basic social services, such as education and health, are all crucial for defining India's future. Science, technology and innovation all have an important role to play in achieving these objectives.

Science and technology development have been central to the phenomenal material advancement and efficiency in the use of resources seen in the last hundred years. The pace of change has only accelerated in the last few decades, as globalization and new technology have enhanced people's access to knowledge and their ability to leverage it through collaboration. India has benefited from this epochal transformation by embracing these trends.

Since technological changes typically emanate from established structures, they may at times



re-inforce them and inhibit the advancement of equity and equality. As India seeks a sustained growth of its national income, we must endeavour to harness the tools of science to cater to the needs of the underprivileged and to bridge the gap between the haves and the have-nots.

Nearly 65 percent of our people live in rural areas. The increase in their living standards depends greatly on the growth of agricultural production and productivity. The Twelfth Five Year Plan assumes that a sustained growth of our agriculture at the rate of 4 percent per annum is essential for the achievement of food security for our country. This growth is constrained by shortages of water and also of land. We need new breakthroughs in water-saving technologies of cultivation, enhancement of land productivity and development of climate-resilient varieties. This transformation of agriculture must be the top priority concern of our public policies, including science and technology policies.

In keeping with the theme of this Congress, the question naturally arises as to what we should do to build our future through science? I would like to share a few ideas.

First, we must, as a society, enhance the spread of what Jawaharlal Nehru used to describe as the scientific temper. Our younger generations must adopt a science-based value-system in order to benefit from what science can offer and to make up for lost time. Complex issues, be they genetically modified food or nuclear energy or exploration of outer space, cannot be settled by faith, emotion and fear but by structured debate, analysis and enlightenment. A scientific approach and understanding of these issues are therefore as vital as our core scientific capabilities.

For this, we must invest in popularizing science, not only in our schools and colleges – as we are doing through the INSPIRE programme – but also in our homes, workplaces and communities through all available communication methods, like the high-speed optical fibre National Knowledge Network. Eventually, science must help in establishing an inclusive society that seeks to solve major social problems through the application of science.

Second, our scholarship and research must be informed by a keen awareness of our basic social and economic realities. Given the limited resources that we, as a nation, are able to devote to scientific research, it is imperative that we give priority to meeting those challenges which are fundamental to the transformation of our economy.

I have already referred to the need to transform India's agriculture. But there are other equally valid concerns as well which require priority attention. The quest for energy security, sanitation, provision of safe drinking water, labour intensive manufactures and universal healthcare at affordable cost are other areas of high priority concern. Our effort should be to carve out a niche for India's leadership in some of these areas. Indian industry must play an active part in this process through in-house research centres and, more importantly, through enhanced academia-industry interaction.

Third, a holistic organizational approach is essential. There was a time when science took a lonely road, driven by individual enterprise rather than collective effort. This is sub-optimal in the innovation and knowledge-intensive world that is empowering the growth process today.

We need cross-fertilization of disciplines and synergy among stakeholders. Government-sponsored research must be supplemented by research in private labs. Academic and research systems must foster innovation and entrepreneurship and therefore link up with those interested in commercial development.

In the last few years, we have taken some policy measures in this direction. We have encouraged sharing of and access to Government-owned data for research. We have also created new mechanisms like Innovation Complexes, Technology Business Incubator and Innovation Universities in an effort to bring about convergence of interests among the various players in science.

Fourth, international collaboration is vital for increasingly resource-intensive modern science to progress. Economic liberalization and economic growth over the last several years have made it possible for our scientists to collaborate meaningfully and confidently in the international arena. Let me cite only two outstanding examples. There was significant Indian collaboration with the European Centre for Nuclear Research on the Large Hadron Collider, which led to the discovery of what is believed to be the elusive Higgs boson. The other example is our work with a select group of countries on the International Thermonuclear Experimental Reactor.

We must partner not only with established leaders in science and technology, but also with emerging innovation powerhouses, many of them in our region. We must also offer our expertise to our neighbours for collective prosperity and progress.

Finally, the quality of our scientific institutions will depend upon the quality of the students we can attract into science, the freedom we give them in pursuing scientific research and the human resource policies we follow in selecting leaders. We must select only the best and we must expand our search to the many Indian scientists abroad who may wish to return to India at least for some years.

The solution of even the simplest of problems related to humanity's pressing needs often requires first-rate fundamental research. During the last eight years, we have tried to fill this gap by expanding the infrastructure of our scientific research and innovation. We have established five new Indian Institutes of Science Education and Research, eight new Indian Institutes of Technology, sixteen new Central Universities, ten new National Institutes of Technology, six new R&D institutions in the field of biotechnology and five institutions in other branches. It is my hope that all this will significantly raise the quality of scientific research in our country.

Given that science-led innovation is the key to development, the National Innovation Council has also brought the domain of innovation to the foreground, helping translation of knowledge into usable solutions.

The Science, Technology and Innovation Policy 2013 released here today aspires to position India among the top five global scientific powers by the year 2020. It is an ambitious goal. It aims to produce and nurture talent in science, to stimulate research in our universities, to develop young leaders in the field of science, to reward performance, to create a policy environment for greater private sector participation in research and innovation and to forge

international alliances and collaborations to meet the national agenda. The Twelfth Five Year Plan, which was approved by the NDC a few days ago, outlines a number of initiatives which will make this possible.

An important step in this direction in the Eleventh Plan was the establishment of the National Science and Engineering Research Board as an autonomous funding body. As pointed out in the Twelfth Plan, this institution proposes to invest in researches of proven track record and establish about 200 to 250 centres based on a grant model with performance reward linkages.

I would like to conclude by recalling Gurudev Rabindranath Tagore's immortal lines in which he prayed for a future India where, among other things, a "clear stream of reason" would prevail. I am confident that, in the next five days, this confluence of leading lights of science from home and abroad will throw up useful ideas on how science will shape the future of India. As the Indian Science Congress crosses another milestone, let us pledge to keep alive the passion of its architects for truth that is eternal and beautiful and their dream to lead India to greater heights of knowledge.

Let me also take this occasion to wish all those gathered here a very Happy New Year."

### **PM Unveils New Science, Technology and Innovation Policy**

The Prime Minister Dr. Manmohan Singh, unveiled the Science, Technology and Innovation Policy (STI) 2013 by presenting its first copy to the President of India Shri Pranab Mukerjee at the inaugural session of the Centenary session of the Indian Science Congress.

The STI Policy seeks to send a signal to the Indian scientific community, both in the private and public domain, that *science, technology and innovation should focus on faster, sustainable and inclusive development of the people*. The policy seeks to focus on both *STI for people and people for STI*. It aims to bring all the benefits of Science, Technology & Innovation to the national development and sustainable and more inclusive growth. It seeks the right sizing of the gross expenditure on research and development by encouraging and incentivizing private sector participation in R & D, technology and innovation activities.

The policy also seeks to trigger an ecosystem for innovative abilities to flourish by leveraging partnerships among diverse stakeholders and by encouraging and facilitating enterprises to invest in innovations. It also seeks to bring in mechanisms for achieving gender parity in STI activities and gaining global competitiveness in select technological areas through international cooperation and alliances. The policy goal is to accelerate the pace of discovery, diffusion and delivery of science led solutions for serving the aspirational goals of India for faster, sustainable and inclusive growth. A Strong and viable Science, Research and Innovation system for High Technology led path for India (SRISHTI) are the goal for the STI policy.

### **The Key features of the STI policy 2013 are**

- Promoting the spread of scientific temper amongst all sections of society.
- Enhancing skills for applications of science among the young from all social sectors.
- Making careers in science, research and innovation attractive enough for talented and bright minds.
- Establishing world class infrastructure for R&D for gaining global leadership in some select frontier areas of science.
- Positioning India among the top five global scientific powers by 2020 (by increasing the share of global scientific publications from 3.5% to over 7% and quadrupling the number of papers in top 1% journals from the current levels).
- Linking contributions of Science Research and innovation system with the inclusive economic growth agenda and combining priorities of excellence and relevance.
- Creating an environment for enhanced private sector participation in R & D.
- Enabling conversion of R & D output with societal and commercial applications by replicating hitherto successful models, as well as establishing of new PPP structures.
- Seeking S&T based high risk innovation through new mechanisms.
- Fostering resource optimized cost-effective innovation across size and technology domains.
- Triggering in the mindset & value systems to recognize respect and reward performances which create wealth from S&T derived knowledge.
- Creating a robust national innovation system.

### **Aspirations of the Policy**

The main aspirational elements of the STI policy are:

- Raising Gross Expenditure in Research and Development (GERD) to 2% from the present 1% of the GDP in this decade by encouraging enhanced private sector contribution.
- Increasing the number of Full Time Equivalent (FTE) of R&D personnel in India by at least 66% of the present strength in 5 years.
- Increasing accessibility, availability and affordability of innovations, especially for women, differently-abled and disadvantaged sections of society.

### **Mechanisms**

Wide ranging mechanisms are envisaged to be deployed to realize the policy aspirations, a few of these are:

- Promoting the spread of scientific temper amongst all sections of society.
- Enhancing skill for applications of science among the young from all social strata.
- Making careers in science, research and innovation attractive enough for talented and bright minds.
- Empowering women through appropriate STI inputs and investments
- Facilitating private sector investment in R&D centres in India and overseas.
- Promoting establishment of large R&D facilities in PPP mode with provisions for benefits sharing.

- Permitting multi stakeholders participation in the Indian R&D system.
- Treating R&D in the private sector at par with public institutions for availing public funds.
- Bench marking of R&D funding mechanisms and patterns globally.
- Aligning Venture Capital and Inclusion Innovation Fund systems.
- Sharing of IPRs between inventors and investors.
- Modifying IPR policy to provide for marching rights for social good when supported by public funds and for co-sharing IPRs generated under PPP.
- Providing incentives for commercialization of innovations with focus on green manufacturing.
- Closing gaps in the translation of new findings at the grassroots and the commercial space.
- Forging strategic partnerships and alliances with other nations through both bilateral and multilateral cooperation in science, technology and innovation.
- Triggering ecosystem changes in attitudes, mindset, values and governance systems of publicly funded institutions engaged in STI activities to recognize, respect and reward performances which create wealth from S&T derived knowledge.

### **Inauguration of Children Science Congress**

The Children Science Congress was inaugurated by former President of India Dr. A.P.J. Abdul Kalam in Kolkata at S.N. Bose National Center for Basic Sciences today. Speaking on the occasion Dr. Kalam said the this Indian science congress standing is on the shoulders of great scientific minds SN Bose, JC Bose, Meghnath Saha, Sir CV Raman, Srinivasa Ramanujan, Homi Bhabha and Vikram Sarabhai and many great scientists. He said would like to share few thoughts on the topic “Excellence in thinking and actions”.

Dr. Kalam asked the young buds present on the occasion to take science as a life mission with excellence in thinking and action by striving to work with their utmost potential . I would like to focus on importance of two great needs: Value to science and scientific magnanimity. He also spoke about energy conservation and building scientific temperament.

Dr. Kalam said “History has proven that those who dare to imagine the impossible are the ones who break all human limitations. In every field of human endeavor, whether science, medicine, sports, the arts, or technology, the names of the people who imagined the impossible and achieved are engraved in our history. By breaking the limits of their imagination, they changed the world.”

The former president also shared his interaction with students in State Children Science Congress (2012) Uttar Pradesh State Science Congress at Barabanki, Southern Regional Science Congress at Coimbatore, Tamilnadu, Mega Science Fair at Darbhanga (Bihar) and National Children Science Congress at Varanasi.

He also referred to the recent development by two teams at the CERN Laboratory towards the discovery of the “God Particle” , a popular name for an elementary particle called Higgs Boson,

named after a great scientist Peter Higgs and Already some progress is being made in this direction in 2011, and it may be possible that within the next few year, we would be able to understand better about the God's Particle and unravel the mystery of why matter exists and how universe came into being. Dr. Kalam said ,I am sure, some of you, as scientists of tomorrow would be finding such sub-atomic, fundamental physics as a research area for your scientific pursuits and would play a vital role in discovering more about this unique area of particle physics.

. Presiding over the session Union Science & Technology and Earth Science Minister Dr. S.Jaipal Reddy said the future of India will be shaped by the emerging force, the youth of the Nation and in the words of Pandit Jawahar Lal Nehru, as he quoted in the "Discovery of India" - "Old as we are, with memories stretching back to the early dawns of human history and endeavour, we have to grow once again, in tune with our present time, with the irrepressible spirit and joy of youth in the present and its faith in the future.

Shri Reddy said Dr. Kalam, apart from making signal contributions in the field of technology and public life, has made abstruse subjects like science and technology inspiring for children and youth in their impressionable years. Nobody has proved to be a greater source of positive energy and soaring inspiration than him in recent years.

The Minister impressed upon the need to invest in today's youth, both in terms of resources and mentoring support, as our first Prime Minister Pt. Nehru did in setting up such temples of learning as Atomic Energy Commission and IITs. Our Government realizes the inestimable value of such investments. He urged senior scientists of today to extend all the mentoring support to budding researchers. He said "Let us together build an India which is a leader in science and technology in the world".

The Minister said we have a dynamic, developed and diversified industrial and service sectors, established on the strength of our own techno-entrepreneurial talents. Our technological achievements are substantial and in certain areas, these are world class. The country today has over 700 R&D, technical and development centres of the top global companies, employing over 150,000 scientists and engineers. This confidence of global majors in our youth has given fillip to some of India's best and talented young technocrats to become first generation technopreneurs. And, most importantly, all of this has been achieved in a framework of a vibrant pluralistic democracy.

Shri Reddy referred to the scheme "Innovation in Scientific Pursuit for Inspired Research" INSPIRE launched by the Department of Science and Technology and said that Under this scheme around nine lakh awards for youth in the age group of 10-32 years has been provided. Besides this INSPIRE supports science camps for top 1% performers at class level across all school boards. It also provides high value scholarship for study of science courses at undergraduate levels, offers research fellowships for doctoral research and creates assured opportunity for careers with research by providing faculty awards for 5-year contractual assignments and research grants..

Referring to the newly announced Science, Technology and Innovation Policy, Shri Reddy said

it conveys India's aspiration to emerge as one of the top global knowledge powers. The new policy also stresses the importance of research that culminates in innovation. It seeks to highlight the need to integrate science, research and innovation to develop valuable technologies. He said we have also initiated a PM Doctoral Research Fellowship in partnership with industry. Already 30 fellowships have been awarded to doctoral students. To me this is a landmark initiative and I hope that in coming years the young recipients of the Fellowship will be instrumental in shaping a glorious future of science in India, the minister added.

On this occasion some young students from different parts of country were also presented with the ISCA - Infosys Travel Awards by Dr. Kalam.

### **Pride of India Expo**

One of the major attractions of 100th ISC – the Pride of India (PoI) Expo was held at the Salt Lake Stadium Complex from 3 – 7 January 2013. It was inaugurated by Shri Jaipal Reddy, Hon'ble Minister of Science and Technology and Earth Sciences in presence of Dr. T. Ramasami, Hon'ble Secretary, DST, Prof. Sameer Brahmachari, DG, CSIR and Secretary, DSIR, Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences and such other dignitaries.

Complimenting the 100th edition of ISC, the PoI Expo, spread over an area of approx. 12,000 sqm with participation of over 200 organisations was a confluence of new ideas, innovations and products covering the entire canvas of scientific world. *Special Pavilions* at PoI Expo were "**Hall of Pride**" (HoP), designed to raise a toast to the life and works of **Pt. Jawaharlal Nehru** - The first Prime Minister of India and also the General President of Indian Science Congress; **Hon'ble Justice Sir Asutosh Mookerjee** - A prolific Bengali educator and the first Indian Vice Chancellor of the University of Calcutta and also the first General President (GP) of Indian Science Congress Association (ISCA); "**Edu Vision**" brought various educational institutions under one roof & other stake holders in education sector; "**International Pavilion**" hosted stalls of different countries showcasing their respective joint R&D/S&T ventures with India.

**Vigyan Jyot (VJ) – Flame of Knowledge**, (conducted since 97th ISC) organized by MM Activ Sci – Tech Communications is a novel initiative to popularize science and encourage pure science as career amongst the youth thus preparing scientists and innovators for future. VJ was flagged off ceremoniously, mounted on a float on 17th December 2012 from Delhi to reach University of Calcutta on 2nd January 2013 by road. It was enthusiastically supported by Nehru Yuva Kendra Sangathan & National Service Scheme (NSS) of Ministry of Youth Affairs & Sports throughout its journey which ensured participation of large number of youth in the VJ programmes held in various educational institutions en-route. The VJ was relit at the site of PoI Expo by Dr. T. Ramasami, and Prof. Sameer Brahmachari on 3rd January 2013 after inauguration of the Expo. This torch remained lit throughout the 100th ISC inspiring all the visitors at the expo to lead life with scientific temperament.

During the valedictory function, the VJ torch was handed over to Prof. R. C. Sobti, General President (GP) Elect 101st ISC by Dr. T. Ramasami, Secretary DST and representative of GP 100th ISC.

### **Women's Science Congress**

The inauguration of the 2<sup>nd</sup> Women's Science Congress took place on January 4, 2013 as a part of the 100<sup>th</sup> Indian Science Congress at the Satyendranath Bose National Centre for Basic Sciences in Kolkata. The following dignitaries delivered their addresses in the inaugural session. Shri S.Jaipal Reddy, Hon'ble Union Minister, Science & Technology & Earth Sciences, GoI, Dr. G. Kalonji, ADG, UNESCO, Paris, Dr. T. Ramasami, Secretary, DST, GOI, Prof. Suranjan Das, Vice-Chancellor, University of Calcutta, Dr. V.L Saxena, General Secretary, Scientific Activities, ISCA, Vote of thanks was proposed by Prof. Mamata Ray, Pro-VC (BA&F), University of Calcutta and Convener, WSC-2013

A panel discussion was held on January 5, 2013 at 10:00 am entitled: **Gender Empowerment- Policy Issues**. It was chaired by Dr. G. Kalonji, ADG, UNESCO and the eminent panelists were Dr. Sudha Nair, Vice Chairman, Golden Jubilee Biotech Park for Women, Chennai, Dr. Archana Bhattacharya, Ex Director, Indian Institute of Geomagnetism, Mumbai, Dr. Sanghamitra Banerjee, Professor, ISI, Kolkata, Justice Ruma Pal, Retd. Judge, Supreme Court of India, Dr. Vibha Gupta, Chairperson, Magan Sangrahalaya Samiti (NGO), Wardha

The second session entitled **Women from Academic Sector** was chaired by Dr. Archana Bhattacharya Ex Director, Indian Institute of Geomagnetism, Mumbai at 11:45am on January 5, 2013. The speakers were: Dr. Hemlata J Wankhede, Director, Government Institute of Science, Aurangabad, Prof. Jyoti Das, Retd. Prof. of Mathematics, University of Calcutta, Prof. Chitrani Medhi, Professor of Chemistry, Guwahati University, Guwahati, Prof. Nilanjana Sanyal, Dept. of Psychology, University of Calcutta, Neerja Agarwal, CSA, Kanpur, Navrati Saxena (South Korea)

The third lecture session entitled: **Women health and Science** took place. It was chaired by Prof. Gourie Devi, Eminent Professor of Neurology, and the speakers were Prof. M.V. Padma, AIIMS, Delhi, Dr. Neeru Singh, Director, Regional Medical Research Centre for Tribals, Jabalpur, Dr. Indira Chakraborty, Former Director, All India Institute of Hygiene & Public Health, Kolkata; Dr. Asha Chandola-Saklani, Consulting Professor Eminence, Apeejay Education Society, Gurgaon, Dr. Sikha Sharma, National Co-



Chair (Health), India

On January 6, 2013 at 10:00am, the lecture session entitled: **Showcasing Contribution of Women** was chaired by Prof. Rohini M. Godbole, IISc, Bangalore. The illustrious speakers were Dr. Tessy Thomas, Project Director, Agni V (C), DRDO , Hyderabad, Dr. Amudeswari, Director, CICS, Chennai, Dr. Rita Kumar, IGIB, Delhi, Ms. Mirai Chatterjee, Director, SEWA, Ahmedabad

Dr. Y. T. Lee, Nobel Laureate in Chemistry (1986) accompanied by Dr. T. Ramasami, had an interactive session in which he shared his valuable views in an inimitable fashion, on women's participation in the field of Science & Technology.

The concluding session of Women's Science Congress – 2013 on January 6, 2013 at 1:30 pm had the following dignitaries Prof. Geetha Bali, General President, 99<sup>th</sup> Indian Science Congress- 2012 and Former Vice Chancellor, Karnataka State Women's University, Dr. Shashi Ahuja, Scientist F/Director, DST, Govt. of India, Dr. (Mrs.) Vijay Laxmi Saxena, General Secretary (Scientific Affairs), ISCA, Prof. Mamata Ray, Pro-Vice-Chancellor (BA&F), University of Calcutta. Prof. Sumita Jha, Professor of Botany, University of Calcutta proposed the formal vote of thanks

Among 35 posters 5 were awarded for their distinguished presentation and the certificates of merit were distributed.

### **6<sup>th</sup> Science Communicators' Meet- 2013**

The inauguration of the 6<sup>th</sup> Science Communicators' Meet took place on January 4, 2013 as a part of the 100<sup>th</sup> Indian Science Congress at the auditorium of Techno India University at Sector V, Salt Lake, Kolkata. Dr. Vijaylaxmi Saxena, General Secretary, Scientific Activities, ISCA , gave welcome address. The SCM was formally inaugurated and the book of abstract was formally released by Dr. K. Kasturirangan, Hon'ble Member, Planning Commission, Govt. of India. Dr. Manoj Chakrabarti, Secretary, Membership Affairs, ISCA was also present. Prof. Sekhar Bhattacharjee narrated the objective of the programme. The session was presided by Dr. B. P. Singh, Head, NCSTC, DST, Govt. of India.

The programme consisted of 5 technical sessions where 34 speakers selected from 19 ISCA Chapters from across the country delivered lectures and presented posters. The awardee of B.C.Deb memorial award for popularization of Science, Dr. Debashis Mandal from Central Soil & Water Conservation Research & Training Institute delivered a lecture entitled: The farmer-first paradigm in science: Reaping benefits of resource conservation for healthier land husbandry.

Valedictory session of the SCM was held on January 5, 2013. Following were the dignitaries on the dais who delivered their lectures at the valedictory session - Dr.(Mrs.) Vijay Laxmi Saxena - General Secretary (Scientific activities), ISCA, Prof. Sekhar Bhattacharjee - Chairman, SCM-ISC-2013 summarized the programme, Dr. Manoj Pattariya, DST, GOI, Prof. U.C. Goswami - Gwahati University, Prof. Suranjan Das - Vice-Chancellor, University of Calcutta, Dr. Amit K De, Executive Secretary, ISCA offered the formal vote of thanks.

## **100<sup>TH</sup> INDIAN SCIENCE CONGRESS**

**3-7 JANUARY, 2013, KOLKATA**

### **RECOMMENDATION OF SECTIONAL COMMITTEES**

**(AS RECEIVED FROM SECTIONAL PRESIDENTS)**

#### **Agricultural and Forestry Sciences**

1. Integrated farming system model involving livestock and dairy sector is essential for ushering evergreen revolution in the country.
2. Group farming consisting of a collective approach of a farming community to work together with appropriate work distribution is needed for livelihood security of resource poor farmers.
3. Custom hiring, market intelligence, family-farming agribusiness, use of cooperative system model for procurement of farm produce of government needs to be promoted to ensure best economic return to farming community.
4. There is a need to develop new watershed models involving principles of convergence, collective action, capacity building and consortium for technical backstopping for improving productivity in rainfed areas. Watersheds should be developed in a business

model through knowledge based entry points and the benefits must be shared among the farmers.

5. ICAR models like promoting village climate risk management committees, capacity building among farmers, building social capital, encouraging farmer innovations, farming and rural employment for social harmony (FRESH), linking farmers to markets, FARMERS FIRST and STUDENT READY, women empowerment through mechanization, National Initiative for Climate Resilient Agriculture (NICRA) need to be popularized in participatory research mode.
6. Major challenges for second green revolution are less availability of arable lands, water scarcity, low productivity, declining soil health, small holdings of farmers, declining biodiversity, climate change, low purchasing power of farmers, poor marketing etc. Therefore, opportunities lie with developing genetically modified crops which can alleviate abiotic stress (RAPB gene), stress resilient crop varieties, C4 rice and potato cultivars and biofortification of cereals with Fe and other essential nutrients
7. Eastern India is a sleeping giant with immense resources and potentiality. The second green revolution must start from this region through use of improved cultivars, enhancing input use efficiency, soil health improvement, decreasing post harvest loss and value addition, increasing income of farmers and developing climate resilient agricultural technologies.
8. There is a need for farm innovations and significant breakthrough in the technologies through high density vertical farming, roof top gardening, protected agriculture and precision farming, water saving techniques, public-private-partnership (PPP) etc .
9. Frontier scientific tools and long term strategy and policy research are required to mitigate the impact of climate change on agriculture.
10. Imparting training and education to youth for adoption of agriculture science as career and knowledge sharing with farming community is essential
11. Small and marginal farmers produce 80% of farmland and support 2.5 billion people. Therefore “National Year for family farming” needs to be celebrated with enhanced investment in agriculture for improving livelihood of agri-based people
12. Like in China, proportion of high yielding hybrids should increase in our country to cover half of the area so that it can produce additional 5000 tons of food from same area. Similarly efforts should be undertaken for developing hybrids in pigeon pea crop

13. Protection of valuable agricultural land, prevention of its fragmentation and consolidation together with effective Government interventions and policy support should be accorded top priority

### **Animal, Veterinary and Fisheries Sciences**

1. Special emphasis needs to be given for development of mariculture with focus on open sea cage fish farming and enclosure farming technology in floodplain wetland and reservoirs for enhancing shellfish and finfish production in the country
2. Technologies need to be upgraded for utilization of inland saline areas in the country for shrimp production
3. Environment flow requirements in major river basins of the country need to be worked out to develop strategies for restoration of degraded habitats and fisheries
4. India needs to take lead in tropical ecological research initiatives with focus on riverine fisheries resources for sustainable rural livelihood development. A tropical Chapter is proposed to undertake the leadership across the temperature gradient along the equator.
5. Bringing major river systems under the concurrent list and establishing single authority to ensure holistic management of riverine health and fisheries integrating ecosystem based approaches.
6. Taxonomical aspects have been grossly neglected during recent past. However, this branch of science is of critical importance for conducting ecological and biodiversity related research and assessment of the ecological integrity of the rivers for implementation of amelioration / conservation measures.
7. Development of modern animal health management system with serological, molecular and sensor based diagnostic tools for various diseases diagnosis and new vaccines for disease control should be given priority.
8. Bioprospecting of flora and fauna, both terrestrial and aquatic, for value addition and their utilization for human benefits
9. There is need for management and research input for increasing milk, meat and egg yield per animal/ bird and explore possibilities of transgenic and high yielding animal/ bird and feed and fodder production.
10. Integrated farming needs to be promoted on a wider scale with newer components for production of diversified edible biomass; sustainable increase in productivity and re-

cycling of materials for overall economic viability.

11. Ichthyofaunal diversity in India is under threat due to various factors like climate change, pollution, disease outbreak, overfishing, etc. There is need for holistic assessment of biodiversity and the drivers that affect it and plan and implement mitigation action plans.
12. Proper documentation of ITKs to formulate future research programs to manage animal and fishery resources in the country.
13. A Dynamic National Informatics System with database on resources, production and productivity, socio-economics, etc. both in animal sciences and fisheries should be developed and established for informed decision support and planning.
14. Biodiversity rich Island ecosystems need to be conserved and sustainably exploited.
15. Programme should be developed and implemented for the development of specialized human resource for fish health management with basic background in fishery science.

#### **Anthropological and Behavioural Sciences (including Archaeology and Psychology & Educational Science and Military Sciences)**

1. Application of human sciences should be given greater prominence in policy making for shaping the future of society, especially with regards to socially marginalized groups for an inclusive society.
2. Promoting action research to further and understanding the phenomenon of social and political violence and to mitigate its impact by making the individuals and communities more productive resources for shaping the future of India.

#### **Chemical Sciences**

1. It is recommended that the quality of chemistry teachers of schools and colleges be upgraded for building solid base and for creating more excitement amongst children to opt for careers in chemical sciences.
2. It is proposed to devise effective ways and means to improve quality of Ph.D. work in chemical sciences.
3. Recommendations are made to strengthen teaching of Nuclear and Radio-chemistry at graduate and post-graduate levels in all colleges and universities to cater to the impending demand of highly trained manpower in the wake of expanding nuclear energy needs of our country.

4. It is recommended that citation impact of publications in chemical sciences shall be enhanced by improving the quality of research.
5. Less than 3% Bhatnagar awardees and less than 1% INSA fellows are women. Hence, a balancing act is needed while top awards in chemical sciences are decided.

### **Earth System Sciences**

1. Focused research should be taken up to develop system early warning of Earthquake.
2. Efforts to be strengthened to ensure safe potable water to everyone, specially in the rural areas
3. Research towards developing action plan for mitigating the impact of climate change.

### **Engineering Sciences**

Technologies for sustainable energy are to be developed and implemented through application of material and environment friendly process and R & D are needed further in the area of renewable energy.

### **Environmental Science**

1. Use of Bio-pesticides and Bio- fertilizers should be promoted for Environmental friendly agriculture.
2. Microbial remediation, phytoremediation and other related technologies are essentially needed for solving environmental pollution related problems, such research and development activities should immediately be initiated, concerning all the stake holders.
3. Development of green technologies are need of the hour, energy options such as solar and nuclear as well as bio-mass energy are to be explored in its best possible way. All possible safe guards are recommended to be taken for nuclear energy so that the efficiency and advantage can be optimized fully.
4. Climate change impacts, mitigation and adaptations strategies should be addressed. Special emphasis should be given to ecologically sensitive areas in

India.

5. Safe access to pure drinking water must be ensured. Studies are recommended or maintaining the quality of both surface and ground drinking water.
6. Exploration, inventrization, documentation and conservation of biodiversity are recommended to be completed at the earliest.
7. Habitat conservation with special emphasis on wetlands, Mountains, Forest, Coast and riverines are recommended.

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

1. To formulate policies, programmes and ICT applications to reach the rural communities, Urban poors, school children, Agriculture based people and other deprived classes to minimize poverty, ignorance, illiteracy, Malnutrition and basic miseries to improve the livelihood and life styles of the citizens.
2. To government, civil societies, Scientific & Technical bodies to promote ICT applications with availability of minimum ICT tools, band width for Network applications to schools & Colleges, Gram Panchayats, NGOs & Women organization to minimise the digital divide.
3. To promote computing and IT power in the areas of Health Care, Agrobased activities and Scientific Research to help develop non-expensive and people friendly hardware & software for proper development the related beneficiary groups.
4. To central & State Governments for allocating sufficient funds to promote the ICT applications in all developmental areas & fields for the inclusive growth with ICT applications.

### **Materials Science**

1. High-energy materials
2. Development of science and technology of biomaterials

### **Medical Sciences (including Physiology)**

1. To promote research works on cognitive and neuro degenerative diseases (particularly Alzheimers's and Parkinsons). More funds are needed to pursue research in these area.
2. Musculoskeletal disorders are on the rise in India. Policy to be framed in such a way that researches in this area get stimulated with more projects and funds. Disorders due to occupation be given priority.
3. To promote research works on the ameliorative role of natural products against neuro-degenerative disorders, cancers, diabetes, different types of cardio myopathies and nutritional deficiency diseases.

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

1. The need for early diagnosis of various diseases (like cancer, hepatitis) and understanding their biology is required to be explored in a large scale with imaging, nanoparticles and other methods for early intervention
2. Focus should be to improve and develop methodologies for assessing tumor response as well as to initiate newer methods of treatment like stem cell therapy targeted delivery etc.

### **Plant Science**

1. A special effort be made to develop a post-graduate course which will impart knowledge about the principles of explorations, documentation, collection, domestication, cultivation and reproduction of RET species from the wild and conserve them and reintroduce to their natural habitats.
2. Personnel trained in taxonomy in the AICOPTAX programme or after offering advance courses in taxonomy should be employed at the entry point in Botanical Survey of India and Zoological Survey of India (after due assessment) so that they will fill in the positions that will fall vacant after retirement of the present scientists.
3. Establish international collaboration for planning research on biosystematics, phylogeny and evolutionary biology.
4. India had a lead in chromosome botany. Unfortunately most of the schools that were pursuing this work switched over to more fashionable branches like cell and molecular biology. The result is that three fourths of flowering plants in India have not even been



censored for chromosome number. There is need to resurrect chromosome botany.

5. In view of the imminent adverse effects of climate change on the reproductive phase of plants, there is need to study reproductive biology to expose the intricacies of plant reproduction.

