



Mrs Mohini Giri taking part in the discussion on Science of Aging

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In view of the unmistakable evidence that the developing countries in Asia including India are going to increasingly face the psycho-social, economic, biological and medical problems of the inevitable large number of aged population in near future, there is an urgent need to develop policies and programs to meet these challenges. Fortunately, the current demographic profile in India provides us a window of opportunity to initiate appropriate action now.

Many of the policy challenges associated with aging population can benefit from greater scientific inputs both from social and natural sciences. International collaboration with science academies in this regard would be valuable.

This requires active encouragement for socio-economic longitudinal studies on the lines of LASI and simultaneous support for research in the field of biogerontology and establishment of geriatric medicine departments/centres in the country.

The National Policy for the Aged formulated by Government of India in 1999 needs revision and strengthening based on emerging scientific knowledge.

The National Science Academies can play a vital role in promoting these activities.

Representation and Participation in the International Meetings and Conferences

Professor M Vijayan, the then President INSA alongwith Dr. Mahtab S. Bamji, Vice-President, INSA attended the meeting of the Science Academies of G8+5 countries including Brazil, PR China, India, Mexico and South Africa hosted by the Royal Society of Canada in Ottawa from April 6-8, 2010. During the meeting two Joint Science Academies statements on 1. *Innovation for Development* and 2. *Health of Woman and Children* were drafted in preparation of the G-8 Summit held in Ontario, Canada during June,2010.

Dr. Krishan Lal, President, INSA, and Professor N. Sathyamurthy, Vice-President, INSA participated in the meeting of the Science Academies of G8+5 countries including Brazil, PR China, India, Mexico, South Africa and Senegal (as a special invitee) hosted by the



Group Photo of the participants at the International Conference on Population Aging



Joint G8+ science academies' statement on Water & Health

Access to clean water and sanitation was declared a human right by the United Nations on July 28th, 2010.

Background

The Millennium Development Goal (MDG) 7C states: "Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation". The Academies of Science of the G8+ countries stress that accessibility, quality and protection of water resources are fundamental to human health in rural and urban areas worldwide. The objectives of MDG7 are imperative in helping to achieve the MDGs on poverty, universal education, food and energy security, gender equality, child and maternal health, most critically, MDG4, reducing child mortality. Diarrhoea-related illnesses kill more children under five years old than AIDS, malaria and measles combined and are the second leading cause of child death. Over 85% of diarrhoea worldwide is due to unsafe water, inadequate sanitation or insufficient hygiene.

A focus on improving sanitation is urgently needed as there has been significantly less progress in this area than in access to safe water. Furthermore, through population growth, increasing pollution and climate change, water as a resource will become scarcer: it is estimated that around 3 billion people will be living in water-scarce countries by 2050. Today, almost 900 million people lack access to a clean water supply, with 2.6 billion people lacking proper sanitation: the direct and indirect effects of a lack of clean water and sanitation are profound.

Within the last decade, more than 1 billion people in the world have now gained access to safe drinking water; much less progress has been made on sanitation and this has a major impact on human health. It is estimated that the MDG sanitation target will not be met in Sub-Saharan Africa for more than half a century; this is clearly unacceptable. An estimated 16% of the population in Europe, and just under 40% of the world population also lack suitable sanitation.

Nearly 20% of the world population - mainly in rural areas - still practise open defecation, resulting in 300 million tons of untreated human excreta polluting fresh water resources each year. This contributes significantly to the transmission of more than 20 different infectious diseases. In addition, domestic animal populations and their excreta are increasing, as diets change to a higher meat intake. Furthermore, improper urban and industrial waste disposal threatens surface and underground water resource quality.

In the absence of improved sanitation, the efficacy of expensive vaccines and chemotherapy to control

water-borne infectious diseases is seriously compromised. Policy-makers must understand that access to drinking water and sanitation facilities go hand in hand. Solving the lack of water services for tap water supply, treatment, hygiene and sanitation would mitigate many other health, economic and social problems. Providing sustainable access to safe water and sanitation is one of the most crucial development interventions in helping poor people to lift themselves out of poverty. It is also one of the most cost-effective public health measures.

Water and health impacts

Major health issues are associated with unsafe water. They include:

- Water-borne infectious diseases - some of animal origin - including cholera, and other diarrhoeal diseases, hepatitis, amoebiasis.
- Water-related vector-borne diseases such as malaria, filariasis, schistosomiasis and dengue, affecting more than 500 million people worldwide.
- Diarrhoeal diseases represent one of the major sources of morbidity/mortality in developing countries, accounting for the death of between 1.5 and 2 million children under the age of 5, annually (UNICEF_WHO, 2010). Alarming, 50% of hospital beds in the developing world are occupied by patients with water-borne diseases.
- Increasing concentrations of organic pollutants through anthropogenic activity (whether industry, agriculture or groundwater management related) and of naturally occurring arsenic, fluoride and nitrates in water all constitute human health hazards. They require either the development of alternative water resources or appropriate cost-effective treatment technologies. Regulations on chemicals need to be improved through better understanding of eco-toxicity and the toxicology of chronic exposure to micro-pollutant mixtures. Traditionally prevalent in industrial countries, chemical pollution is now emerging as a public health concern in developing countries. These countries are now also confronted with massive urbanization. Areas of greatest population density present different challenges to rural populations. The re-emergence of cholera is largely due to the spontaneous and burgeoning growth of mega-cities, townships, shanty towns and favelas with no sewage systems or infrastructure. Major improvements have to be made in sewage treatment.



- Water and sanitation issues can be intrinsically linked to land settlement and whilst access to water and sanitation is now recognised as a basic human right, this is often overlooked for displaced people; a problem that will become all the more important with increasing mass migration.

Socio-economic impacts of sanitation and safer water

The improvement of sanitation and use of safe water would strongly impact:

- **Economical development and lost productivity**
Diarrhoeal diseases account for an estimated 4% of the total DALY (Disability Adjusted Life Year) global burden of diseases, nearly 90% attributable to unsafe water supply, lack of sanitation and hygiene.
- **Education**
Approximately half a billion school days are lost each year due to water-borne diseases. The lack of adequate facilities in schools is one of the factors that prevent girls from attending school, particularly when menstruating. Gender-sensitive sanitation, together with education and hygiene, especially handwashing, has significantly reduced the incidence of water-borne and diarrhoeal diseases, e.g., in Bangladesh and Morocco.
- **Public health**
Promoting sanitation must be a priority for the development of public health if we are to attain the MDGs. Achieving the MDGs will depend on the promotion of international coordination, community-based cost-effective technologies - such as membrane filtration units - that have dramatically improved access to microbiologically clean water from individual to community scales.
- **Integrated Water Management**
An integrated approach to managing at watershed level should address the biogeophysical, climatic, social and economic issues related to water management particularly within river basins.

Recommendations

The Academies of the G8+ countries strongly recommend the following action plan to their Governments:

- Develop basic infrastructure for sanitation and maintenance, to achieve acceptable quality water as key priorities and reduce rural/urban disparities. Sanitary facilities in schools, adapted to local, environmental, technological and cultural constraints, are a priority.
- Promote education, including training of professionals and technicians to improve management of water quality, and public information to change the behaviour of populations regarding water supply.
- Fund research and development for the identification of pathogens of human and animal origin and the development of simple, low-cost and efficient markers. Further epidemiological studies are needed to develop vaccines against water-borne pathogens.
- Promote capacity-building to improve water management and hygiene standards; support watershed level community-based actions favouring the key role of women both in rural and peri-urban areas to echo "unheard voices of women".
- Establish networks of competence at national, regional and global levels to improve the efficiency of water use in domestic context, as well as in agriculture and industry, through research and innovative practices that are ecologically oriented.

The benefits of fulfilling these recommendations are so rewarding, both socially and economically, that the Academies urge the leaders to address this concern and identify methods to meet the financial challenge.

May 19, 2011

Academia Brasileira das Ciências, Brazil

Royal Society, Canada

Académie des Sciences, France

Deutsche Akademie der Naturforscher Leopoldina, Germany

Indian National Science Academy, India

Accademia Nazionale dei Lincei, Italy

Science Council, Japan

Academia Mexicana de Ciencias, Mexicana

Russian Academy of Sciences, Russia

Académie nationale des Sciences et des Techniques, Sénégal

Academy of Sciences, South Africa

Royal Society, United Kingdom

National Academy of Sciences, United States of America



Joint G8+ science academies' statement on Education for a Science-Based Global Development

Education in science must be targeted not only to future scientists, engineers and other specialists but also to the general population.

Background

Economic growth, provision of food and progress in health – as measured by the spectacular increase in life expectancy during the 20th century and into this first decade of the 21st century – is attributable mostly to advances in science and technology and the expansion of systems of research and education. These advances have impacted our daily lives in many ways including travel, communication and access to new technologies. In the future, science and technology will continue to be key for global development, for example, to meet the need for new and sustainable sources of energy.

Education in science must be targeted not only to future scientists, engineers and other specialists in government and industry but also to the general public, from children in school to adults. This is the only way to make them partners of the scientists and hence to avoid misunderstandings and unfounded fears, and to better understand risks and uncertainties.

Science understanding and practice embody fundamental values such as rigorous reasoning, honesty and tolerance for the opinions of others. The practice of science must be accompanied by a sense of justice and a respect for all human beings.

Education for science-based global development involves three simultaneous challenges: science education for the general public, science education in school, and science education at university and at other national research bodies. This will require innovative approaches and institutions for teaching and research, many of them using modern information and communication tools. It requires also scientific assessment of the outcomes of the education system in order to ensure that the best state-of-the-art tools and educational methods are effectively used. Progress in cognitive sciences and brain research has shed new light on learning processes, especially in very early years of life.

Science education for the general public

Science literacy is essential for making adaptive judgments in a modern economy. These judgments involve many choices including, for example, choices about resource scarcity, climate change mitigation,

food safety, health decisions, energy futures and many other individual and collective decisions. A democratic society in which only a few scientists and highly educated people understand the bases for major societal decisions is not viable. Accordingly, it is essential that greater efforts be made to disseminate scientific concepts, methods and discoveries to the public. Scientific information must be distributed widely and detailed briefing documents on topical issues must be available for decision-makers and media. Many successful interactions with society have been organised and carried by local and national governments, universities, public and private research institutes and academies. These include public lectures, 'open houses', festivals, pairing with parliamentarians and TV programmes.

We must use all appropriate education tools, including those presented by rapid developments in the electronic media and help people to identify the reliability of the information presented. Finally, the outcomes of all these education practices must constantly be assessed.

Science education in school

Science is taught at school with two goals:

The first goal is to provide the basic knowledge necessary for future citizens in a globalized world. This includes the acquisition of basic knowledge in science as well as the understanding of the very nature of science, the way to pose and then challenge hypotheses. Students must develop a taste for doing experiments, analyze results, make inferences. In short, they must be "curiosity-driven". During the last decades, inquiry-based Science Education (IBSE) has been successfully implemented in developed and less developed countries as well, supported by the Global Network of Science Academies (IAP).

A basic science education for all youngsters in the world is a matter of justice, sharing the beauty of scientific discoveries and the power of scientific methods. Last but not least, learning to reason properly may help protect young minds against intolerance.

The second goal is to recognise talented youngsters and inspire them to become science teachers, researchers, engineers and medical experts. A shor-



tage of good quality mathematics and science teachers in many countries creates a vicious circle that needs to be broken. In many countries even the most developed, there are still huge social inequalities in the opportunities for students to become scientists particularly for young women and low-income groups of society.

The decline of interest in science among youngsters is a serious issue which should be addressed.

Encouragement of young talents could be organized on the basis of different level competitions in different science domains, accompanied by contacts with leading scientists.

To achieve these goals, it is essential to share experiments and pedagogical materials in innovative science education programs and to provide teachers with a significant continued education in Science. In addition, it is advisable to cooperate with the global programs of Education for Sustainable Development (ESD) promoted by UNESCO.

Science education at university

Universities throughout the world need quality faculty, infrastructure and innovative learning programmes to train and maintain human resources. Databases, electronic libraries, scientific journals and sophisticated software should be widely accessible throughout the world. Access to distant databases creates new opportunities for researchers of all countries particularly in the experimental disciplines. Databases on gene sequences and astronomical objects, for example, can potentially be accessed freely by all researchers, including those from the less-developed countries. Similarly, essential data - such as those on biodiversity - that are acquired everywhere, can now be exploited by the global community of researchers. The effectiveness of e-learning and its highly positive prospects, however, may be limited by the high cost of implementing and using modern techniques.

Although virtual universities may have considerable potential, research centres remain necessary both to conduct experimental works and to facilitate direct interaction between researchers and between faculty and students.

Conclusion

Data on the comparative effectiveness of educational strategies must be patiently acquired, analyzed and the results disseminated. Rigorous experimental approaches should help to identify which educational strategies are the best, at all levels of educational curricula. This "evidence-based education" could revolutionize the science and practice of education, as "evidence-based medicine" did, to the point that it has become, after just a few decades, the paradigm of modern medical practice.

Recommendations

The Academies of the G8+ countries strongly recommend the following action plan to their Governments:

- Establish the conditions for a true globalization of knowledge in science and technology. Encourage and help governments of developing countries, to give high priority to acquiring and maintaining the necessary infrastructure and human resources for science education, and to facilitate the return of those trained abroad.
- Support international collaboration to set up quality e-learning facilities, accessible to all, including students worldwide, and promote open access to scientific literature and databases.
- Share the growing knowledge derived from brain research, cognitive sciences and human behavioural research to improve learning programs for children, students and the general public.
- Create a network of virtual collaborative research centres at the front line of innovations in education, such as e-learning, inquiry-based and evidence-based education.
- Support and expand existing successful programs which facilitate the two-way interactions between scientists, on the one hand and the general public, media, and decision makers, on the other.

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Academy of Sciences, South Africa

Royal Society, United Kingdom

National Academy of Sciences, United States of America

French Academy of Sciences. During the meeting 2 Joint G8+ Science Academies statements on : 1. *Water and Health* and 2. *Education for a Science-based Global Development* were prepared to be presented at the G8 Summit. President INSA also had a detailed discussion with Professor Alain Carpentier, President. French Academy of Sciences on Bilateral Exchange Programme between both the countries and identified a few lead areas where the scientists of both the countries could be exchanged in the near future. It was also decided to energize the *Etienne Wolf and R amanujan Lecture Series* established in the year 2005.

Cooperation with International and Regional Organisations

The Global Network of International Issues (IAP) / Inter Academy Council (IAC)

The Academy continued to take a lead role in the activities of the Inter Academy Panel and International Issues now replaced by a new name-IAP: The Global Network of Science Academies founded in 1994 as a follow-up of the Population Summit hosted by INSA during October, 1993. Professor PN Tandon, Past-President, INSA and Professor F Sherwood Roland, the then Foreign Secretary, USNAS were elected as Co-chairs. The IAP presently has 104 members, one per country. The core function of IAP is to strengthen the capabilities of the Science Academies in all countries, especially in the developing world. In particular the IAP seeks to enhance the capacity of Science Academies to provide effective Science –Based Advice independent of Political or Religious consideration to Governments and Societies. This goal is pursued by assisting scientists in founding an Academy of Sciences within their country; issuing statements on issues of global concern and forming international programmes to be used by members at National level. The Academy (INSA) has been coordinating and contributing to the various IAP programmes since beginning on *Capacity Building for Academies, Water Research and Management, Science Education and Women's Health Education* and other IAP initiatives on *Bio-security, Access to Scientific Information, GMOs and Natural Disaster Mitigation*, etc.

The Academy has also been supporting and participating in the activities of the Inter-Academy Council (IAC) constituted in 2000 as an executive arm of IAP to take up major research projects and policy

investigations and to provide scientific advice to multinational audiences such as the United Nations, the World Bank, and other International Organisation. Professor G Mehta, the then President, INSA and Professor Bruce Albert the then President, USNAS were elected as IAC Board Co-chairs till 2005. The IAP and IAC work closely to increase the effectiveness of their respective missions. The Academy significantly contributed to the five major study reports produced by IAC on (1) *Inventing a Better Future – A Strategy for Building Worldwide Capacities in Science and Technology*, (2) *Realizing the Promise and Potential of African Agriculture – Science and Technology Strategies for Improving Agricultural Productivity and Food Security in Africa*, (3) *Women in Science*, (4) *Lighting the Way: Toward a Sustainable Energy Future* and (5) *Climate Change Assessments*. INSA was elected as member of IAC Board till 2013.

The Academy played an active role in drafting the IAP's long-term Strategic Plan for the year 2007-2009 and 2010-12 and also provided scientific input for the release of the IAP statements on Population Growth; Science Technology and the Future of Cities; Transition to Sustainability; Human Cloning; Science Education of Children ; Health of Mothers and Children; Scientific Capacity Building; Science and the Media; Access to Scientific Information; Bio-security and the Teaching of Evolution; Ocean Acidification and Tropical Forests and Climate Change. .

Professor M Vijayan, President, INSA attended the IAP General Assembly and the IAP Conference on *Biodiversity* hosted by the Royal Society, London in conjunction with the 350th Anniversary Celebration of the Royal Society, London held from January 12-15, 2010. The IAP Conference on Biodiversity held on January 13-14, 2010 marked one of the first International events to take place during the UN-designated year of Biodiversity. More than 200 scientists from all over the world participated in the Conference which examined the broad range of issues related to protection and sustainable use of world's natural resources. A communiqué on *Biodiversity* was also produced which examined Science and Policy knowledge gaps and presented recommendations for strengthening the Society-Science Policy Interface. The IAP General Assembly elected the new IAP Executive Committee for the year 2010-12 with Professor Howard Alper and Professor MHA Hassan as Co-Chairs. INSA



was elected as a member of the IAP Executive Committee.

Professor M Vijayan, the then President, INSA attended the Meeting of the IAP Executive Committee held in Santiago, Chile from 2-5 November, 2010

Dr Krishan Lal, President, INSA and Professor M Vijayan, Past President INSA participated in IAC Board meeting and IAP Executive Committee Meeting held in Washington during March 27-30, 2011. A good number of issues such as Green Technologies, Global Water Resources , Improving Matrices for Global Agricultural Security Policies, Scientific Ethics and Responsibilities were discussed. Besides, IAC also discussed nuclear energy options in the aftermath of recent Japanese earthquake and Tsunami.

On the invitation received from IAP, INSA nominated 2 young Indian scientists namely Dr SK Satheesh and Dr G Mugesh from Indian Institute of Science, Bangalore to participate in the 3rd IAP Young Scientist Conference held in conjunction with the World Economic Forum's Annual Meeting of New Champions in Tianjin, China during 13-15 September, 2010. The theme of the Conference were *Building Successful Business-University Partnership* and *Advancing Green Technology for Sustainability* .

Distinguished Visitors to INSA



Professor LU Yongxiang, President, Chinese Academy of Sciences, Beijing, China receiving the JL Nehru Birth Centenary Medal from the President, INSA on December 22, 2010



Professor Huanming Yang, Director, Beijing Genomics Institute, Beijing and Foreign Fellow of INSA elected in 2010 was greeted and presented the Fellowship Scroll during his participation in the Anniversary General Meeting of India held in Bangalore during December 27-31, 2010



Professor Surendra Raj Kafle, President, National Academy of Science and Technology, (NAST), Kathmandu, Nepal, January 11, 2011



Professor Jorg Hacker, President, German Academy of Sciences, Leopoldina and Foreign Fellow of INSA elected in 2011 was greeted and presented the Fellowship Scroll on January 31, 2011, by Dr Krishan Lal, President, INSA

Mr Koji Omi, Founder and Chairman, Science and Technology in Society (STS) Forum, Japan and former Minister of Science and Technology of the Government of Japan.

Participation in TWAS / TWANSO Meeting and Conference

21st General Meeting of the Academy of Sciences for the Developing Countries (TWAS) was hosted by Indian National Science Academy in association with the LV Prasad Eye Institute at Hyderabad during October 19-22, 2010. About 350 scientists from 60 developing countries and a large number of Indian scientists participated in the meeting. The meeting was inaugurated by the Hon'ble Prime Minister of India Dr. Manmohan Singh.

The Prime Minister stressed on the need for the developing nations to voice their concerns “more forcefully” in evolving scientific policies in areas like climate change and biodiversity. “The work done by the Inter-Governmental Panel on Climate Change and the International Union for Conservation of Nature is of critical interest to us as the impact of climate change is more devastating on the developing world” he said. “As governments we are trying to create greater synergy and coherence in policies among developing countries but these efforts must be backed solid technical inputs” the Prime Minister added. The Academy could play a facilitating role in providing a space for scientific collaboration in critical areas like climate change. Pointing out that the developing world was constrained by lack of well-organised systems and critical mass of expertise in its scientific establishments, Dr. Manmohan Singh emphasized on the need for collaboration of scientific communities. “The problems we cannot solve individually, perhaps we can solve by working together. But each of our countries should put science on a pedestal. We need to invest in science and scientific infrastructure, in our schools and laboratories”, he added.



Prime Minister Dr Singh addressing the inaugural function of the TWAS meeting

INSA Delegation to Nepal

A three member delegation of the Indian National Science Academy headed by Dr Krishan Lal, President, Professor N Sathyamurthy, Vice-President, and Professor Alok Bhattacharya, Vice-President visited Nepal from April 7-11, 2011 to review and broaden the scope of exiting bilateral scientific cooperation with the Nepal Academy of Science & Technology (NAST), Kathmandu. During the discussion meeting held with NAST headed by Professor Surendra Raj Kafle, Vice-Chancellor, NAST, both the sides decided to adopt the flexibility in incrementing the number of scientists exchanged from both the countries and also the exchange of high level INSA and NAST delegation visit once in a year to fortify the relation of both the Academies. Dr. Krishan Lal agreed to support the NAST Data Centre by providing the data available at the CO-DATA Centre and from other sources, forward the list of Journals and Books likely to be gifted by



A delegation led by President, INSA Dr Krishan Lal, with Professors N Sathyamurthy and Alok Bhattacharya visited Nepal Academy

INSA to NAST and also initiate to forge Academic linkages of NAST with the Centre for International Cooperation in Science (CICS), Chennai. Subsequently, the delegation visited the various Universities and Scientific Laboratories/Institutions and delivered the 6 invited lectures on the following topics which were highly appreciated by all the participants.

1. Recent Advances in Growth and Characterization of Single Crystals of Advanced Materials by Dr. Krishan Lal, President, INSA
2. Fascinating World of Crystals by Dr. Krishan Lal, President, INSA
3. Indian Initiative in Science Education by Professor N Sathyamurthy, Vice-President, INSA



4. Chemistry: Melting Boundaries by Professor N Sathyamurthy, Vice-President, INSA
5. Amoebiasis and the Biology for the Parasite Entamoeba Histolytica by Professor Alok Bhattacharya, Vice-President, INSA
6. Next Generation Sequencing and its Application in Modern Biology by Professor Alok Bhattacharya, Vice-President, INSA

Visit of INSA Delegation to Bangladesh

A three member delegation of the Indian National Science Academy headed by Dr. Krishan Lal, President, Professor N Sathyamurthy, Vice-President, and Professor Akhilesh Tyagi, Vice-President visited Dhaka, Bangladesh on 8-10 May, 2011 on the invitation of the Bangladesh Academy of Sciences, (BAS). The programme included visiting and giving Seminars on the frontier areas of Science & Technology at the Physics, Chemistry and Biochemistry and Molecular Biology department of the Dhaka University; Atomic Energy Centre, Dhaka; BCSIR Laboratories and a courtesy call on the State Minister of Science and ICT. The INSA delegation held a discussion meeting with the Council of the Bangladesh Academy of Sciences headed by Professor M Shamsheer Ali, President to explore the possible area of joint collaboration and programmes of scientific activities between the two Academies. Some of the areas on which the BAS gives an emphasis for its programme of activities are: energy including green energy, ICT, science education, climate change, environment, biotechnology, biodiversity, health and hygiene etc. The President, BAS desired to undertake the following programmes in the light of the INSA –BAS MoU:

1. Regular communication on events of the respective Academies
2. Exchange of scientists/Fellows
3. Participation in the conferences/seminars organized by the respective Academies
4. Identification of few specific areas of research collaboration including the scientists / Fellows directly involved in research.
5. Some specific projects related to science education, low cost equipment development for schools and colleges
6. Gender participation in the development of Science and Technology
7. Public Understanding of Science
8. Initiative joint research projects

Dr. Krishan Lal, President, INSA while thanking the Bangladesh Academy of Sciences, (BAS) for responding to INSA initiative for cooperation between the two Academies and inviting INSA delegation, remembered the great scientists of Bangladesh who contributed to the development of modern science & technology. He outlined the background of INSA for gearing the S&T cooperation among the Academies of the region. He further mentioned that the close cooperation between the two Academies would be more fruitful and productive and the resulting scientific achievement through this approach can be focused at the level of International Organisation.

In response to the points mentioned by BAS President, Dr. Krishan Lal mentioned different aspects of affective cooperation between the two Academies as follows:

1. **Communication:** Regular communication between the Academies on different national, regional and international events may be organized by the respective Academy or related organizations. For the events organized by the Academy invitation may be made to relevant Fellows or other relevant scientists through the Academy. For that purpose electronic communication would be a suitable mechanisms. In addition the website has to be updated with events.
2. **Brain storming /workshops:** For identification of specific scientific projects for collaboration: A two day brainstorming session may be organized with relevant scientists sponsored by each Academy to discuss on specific projects and mechanism of implementation. For this purpose two workshops may be held one in India and one in Bangladesh where scientists will have heart to heart interaction to develop effective collaborative projects.
3. **Equipment for science education at secondary and higher secondary levels:** Regarding the problem of equipment at the secondary/higher secondary level science experiment, relevant organization may contact National Council of Science Museum in India.
4. **Public understanding of science:** President INSA mentioned that the public understanding of science is a very board issue and calls for a comprehensive programme on the part of each Academy involving interaction with the press and media, civil society, specific stakeholders, NGOs etc. The INSA under the purview of its Science and Society Programme organizes different programmes like seminars, workshop meetings etc.

5. **Academic programmes/training:** Professor N. Sathyamurthy mentioned about different fellowships offered to students/researchers in neighbouring countries through the Centre for International Cooperation in Sciences (CICS), Chennai, a wing of INSA. He referred to his presentation on the Indian initiatives on science education and suggested that the BAS can take advantage of the different programmes for the working scientists for training and research in India.

Local Chapter Activity

Following Award Lectures were delivered during Janury-March 2011

1. INSA-Vainu Bappu Memorial Award (2010) by Professor S Ananthakrishnan, FNA was delivered on January 12, 2011 at Department of Physics, University of Pune, Pune under the aegis of INSA Pune Local Chapter.
2. Jawaharlal Nehru Birth Centenary Lecture-Biological Sciences (2011) entitled *Structural Studies of Therapeutically Important Mammalian :Proteins* was delivered by Professor TP Singh, FNA at Cauvery Ayuditorium, Karnataka State Open University, Mysore on February 17, 2011 under the aegis of INSA Bangalore Local Chapter.
3. The Indira Gandhi prize for Popularization of Science (2011) entitled *What Makes the Sun Shine* was delivered by Professor BN Dwivedi, Department of Applied Physics, Institute of Technology, BHU, Varanasi at Banaras Hindu University, Varanasi under the aegis of INSA Varanasi Local Chapter.
4. INSA Prize for Materials Science (2011) entitled *Science & Technology of Sodium Cooled Fast Reactors and Associated Fuel Cycles* was delivered by Dr Baldev Raj, FNA on March 14, 2011 at IIT Chennai under the aegis of INSA Chennai Local Chapter.

INSA Srinivasa Ramanujan Medal Lecture

Professor SG Dani, FNA, School of Mathematics, TIFR, Mumbai, delivered INSA Srinivasa Ramanujan Medal Lecture (2011) on *Continued fracvntions and applications to values of quadratic forms* on September 30, 2011 at Harish-Chandra Research Institute, Chhatnag Road, Jhunsi, Allahabad. A summary of the lecture is as follows:

Continued fraction expansions of real numbers have been used in a variety of Diophantine problems, including in particular in the study of values of binary quadratic forms at integer points. The study is also intricately related to the dynamics of the geodesic flow associated with the modular surface.

Continued fraction expansions can also be given for complex numbers in terms of the Gaussian integers (complex numbers with integral real and imaginary parts); the topic had not attracted adequate attention for a long time, even though it had been opened up by A. Hurwitz as far back as 1887, but is now being developed, and in particular was applied to study values of complex binary quadratic forms at Gaussian integers.

The talk will consist of a short survey of the topic of continued fractions, with focus on some recent work on broad aspects of complex continued fractions and applications to values of binary quadratic forms.

Har Swarup Memorial Lecture

Professor SK Saidapur, FNA, Karnatak University, Dharward, delivered Har Swarup Memorial Lecture on *Vertebrate Reproduction: An Evolutionary Approach* on November 04, 2011 at Banaras Hindu University, Varanasi. A summary of the lecture is as follows:

Vertebrate reproduction is a complex interplay of proximate and ultimate factors. Study of structure-function analysis has led to several accomplishments that include fertility regulation, in vitro fertilization, assisted reproduction, overcoming infertility, breeding in captivity, sex reversal in fishes and anurans and so on. However, the strategy of synchronization in gonadal cycles of opposite sexes in seasonal breeders,



Professor SK Saidapur, FNA receiving the Har Swarup memorial award from Professor P Krishna, FNA. Seen on the exteme left is Professor Dhanjay Pandey, FNA



timing reproduction with the favourable season of the year, diverse reproductive modes (oviparity, viviparity, special cases of aplacental viviparity or pseudoviviparity), parthenogenesis in some species, sexual selection, male-male competition, guarding territory, parental care and energy allocation for somatic growth versus reproduction i.e. ultimate factors governing reproduction are poorly understood. Therefore, there is a need for an evolutionary approach for understanding diverse facets of vertebrate reproduction. Likewise, evolution of viviparity is a little understood phenomenon. The Indian garden lizard (*Calotes versicolor*) is a good model to study evolution of many reproductive strategies such as egg and clutch size manipulation and prolonged egg retention is facilitated by the hormone progesterone of adrenal in origin and not from ovarian corpora lutea which degenerate two weeks after ovulation. Interestingly, during this period the cloacal temperature is reduced by 2-4 degrees thereby arresting embryonic development of the retained oviductal eggs. The study provides the first experimental evidence to the 'stress induced evolution of viviparity' hypothesis. The talk emphasized the need to study 'reproductive strategies' from an evolutionary perspective for greater understanding and appreciation of vertebrate reproduction. Such an approach is both challenging and rewarding.

Prasanta Chandra Mahalanobis Medal Lecture

Professor IBS Passi, FNA, delivered Prasanta Chandra Mahalanobis Medal Lecture on *Group Algebras* on November 09, 2011 at Indian Institute of Science Education and Research, Mohali. A summary of the lecture is as follows:



Professor N Sathyamurthy, FNA, presenting bouquets to Professor IBS Passi, FNA after delivering the Medal lecture

Given a group G and a commutative ring R with identity, one can define an R algebra $R[G]$ called the group algebra of G over R . An element $\alpha \in R[G]$ is said to be algebraic if $f(\alpha)=0$ for some non-zero polynomial $f(X) \in R[X]$. We will discuss some of the developments in the study of algebraic elements in group algebras.

MR Das Memorial Lecture

Professor Saumitra Das, FNA, delivered MR Das Memorial Lecture on *Novel antiviral strategies against hepatitis C virus* at Department of Microbiology and Cell Biology, Indian Institute of Science, Bangalore. A summary of the lecture is as follows:

Translation initiation of hepatitis C Virus (HCV) RNA is an obligatory step of the viral life cycle, mediated through the Internal Ribosome Entry Site (IRES) present in the 5'-untranslated region (5'UTR). This mechanism is unique and fundamentally different from the translation mechanism of host cell mRNAs and thus could be exploited as a selective antiviral target. We have shown that a small RNA comprising of the SLIII e+f sub domain of HCV-5'UTR can strongly bind to ribosomal protein S5 and selectively block the 40S ribosomal subunit interaction with the HCV IRES and consequently inhibit translation of HCV RNA. Recently, we have shortened the RNA further and demonstrated that a 34mer (SLR6) RNA can retain the binding of S5 and efficiently inhibit translation and replication of viral RNA in HCV cell culture system. In parallel, we have shown that a small peptide (LaR2C) derived from RNA binding region of human La protein (an important host factor) interferes with the assembly of 48S complexes at HCV IRES and inhibits viral protein synthesis. Additionally, we have demonstrated inhibition of viral RNA translation and



Professor Saumitra Das, FNA, delivered MR Das Memorial Lecture on *Novel antiviral strategies against hepatitis C virus*

replication by another small peptide derived from the RNA binding region of the HCV NS3 protease. Finally, we have tried efficient delivery of these antiviral agents into mouse liver using Sendaivirus fusion protein based virosome system and successfully demonstrated inhibition of HCV RNA translation in the animal model. All these approaches have the potential to block the ribosome assembly on the HCV RNA and thus provide new possibilities for developing effective anti-HCV therapeutics. Taken together, our work demonstrates a strategy to inhibit HCV protein synthesis using a small RNA or peptide that disrupts an essential interaction between the HCV RNA and host ribosomes, providing the promise of an effective anti-HCV therapeutic targeted against an important aspect of host-virus interaction.

Srinivasa Ramanujan Medal Lecture

Professor SG Dani, FNA, delivered Srinivasan Ramanujan Medal Lecture on *Continued fractions and applications to values of quadratic forms* on 30th September 2011 at Harish-Chandra Research Institute, Allahabad. A summary of the lecture is as follows:

Continued fraction expansions of real numbers have been used in a variety of Diophantine problems, including in particular in the study of values of binary quadratic forms at integer points. The study is also intricately related to the dynamics of the geodesic flow associated with the modular surface.

Continued fraction expansions can also be given for complex numbers in terms of the Gaussian integers (complex numbers with integral real and imaginary parts); the topic had not attracted adequate attention for a long time, even though it had been opened up by A Hurwitz as far back as 1887, but is now being developed, and in particular was applied to study values of complex binary quadratic forms at Gaussian integers.

The talk will consist of a short survey of the topic of continued fractions, with focus on some recent work on broad aspects of complex continued fractions and applications to values of binary quadratic forms.

Y Subba Row Memorial Lecture

Dr Chitra Mandal, FNA delivered Y. Subba Row Memorial Lecture on *Deciphering the mysterious role of O-acetylated sialic acids in Leukemia* on 15th November 2011 at Biotechnology Department, Jadavpur University, Jadavpur. The summary of the lecture is as follows:



Dr Hemanta Mujumder handing over the citation and award cheque to Dr Chitra Mandal, FNA

The lecture, among many things, described the exclusive induction of unique sialoglycoproteins on erythrocytes yielding a potential antigen-based technology for diagnosis and monitoring patients with visceral leishmaniasis. She discovered disease-associated glycosylated molecular variants of human C-reactive protein with potential sialoglycoproteins/O-acetylated disialoglycolipids on lymphoblasts of children suffering from acute lymphoblastic leukemia (ALL) for diagnosis, prediction of relapse and detection of minimal residual disease. She detected one leukemic cell in 10,000 normal cells.

Awards & Honours

Civilian Awards

The following scientists (Academy Fellows) received the Civilian Award of the Government of India

Professor Madhav Gadgil, FNA

Padma Bhushan

Professor Roddam Narasimha, FNA

Padma Bhushan

Professor MS Swaminathan, FNA

Padma Bhushan

Professor (Dr) Ebrahimali Abubacker Siddiq, FNA

Padma Shri (Science & Engineering Agricultural Science -2011)

Dr Baldev Raj, FNA has been awarded 10th Indian Nuclear Society Homi Bhabha Lifetime Achievement Award for 2010.

Professor KL Chopra, FNA, has been conferred Freedom of The Institute Award by the Indian Institute of Technology, Delhi on its foundation day the 27th January 2011.



Professor CR Rao, FNA, was awarded an Honorary Degree of Doctor of Science at the first convocation of the Jawaharlal Nehru Technical University, Kakinada, India. This is the 33rd of the honorary degrees he received from universities in eighteen countries spanning six continents. He delivered the convocation address on “The role of statistics as the key technology of the future.”

Professor BL Deekshatulu, FNA, has been awarded National Award by Ministry of Earth Sciences, Govt. of India for his outstanding contributions to Ocean Science & Technology and CHEN Shupeng award by the Chinese National Committee for Remote Sensing/Asian Association for Remote Sensing (AARS) for his outstanding contributions to Remote Sensing and he has also been elected Hon. Member of AARS.

Obituary

Kadavil Poulose Abraham



Kadavil Poulose Abraham (*b* 28 August, 1920; *d* 23 December, 2011) joined the University of Lucknow and obtained MSc (1944) in Chemistry. After a short stint as Lecturer at Maharaja’s College, Cochin, he joined Jaffna College, Sri Lanka (1947) as a Lecturer in Chemistry. In 1956, he joined the Imperial College, London, to conduct research on thermodynamic properties of iron and steel making slags. He obtained his PhD degree (1959) from the University of London. After a year of post-doctoral research at Imperial College, Abraham joined the Department of Metallurgy, Indian Institute of Science (IISc), Bangalore, as an Assistant Professor (1960). He served as Chairman of the Department of Metallurgy, IISc (1972-77). *-14

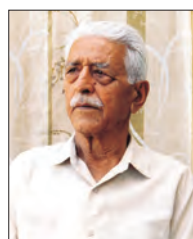
Professor Abraham took an active part in starting the ME degree course in chemical and physical metallurgy at IISc. He set up an extractive metallurgy laboratory and built several equipments for research at high temperatures, with special emphasis on thermodynamic and kinetic measurements of interest to extraction metallurgy. On the process side, he designed and built a pilot scale electro-slag refining unit for steel, which was used to develop process parameters for the manufacture of inclusion-free steels for the aeronautical and defense industries. Professor Abraham’s studies

on sulphur capacity of slags for steel making have been widely cited.

Abraham received the Extraction and Processing Science Award of the Minerals, Metals and Materials Society (TMS), USA (1993). He was one of four living scientists honoured for their pioneering contributions to the field in the last century at the International Conference on Molten Slags, Fluxes and Salts held in Stockholm in 2000. He was elected an Honorary Member of Indian Institute of Metals (IIM) (2005). He is a Fellow of Indian Academy of Sciences, Bangalore and IIM, Kolkata.

Professor Kadavil Poulose Abraham was elected to the Fellowship in 1982.

Dharan Dhar Awasthi



Dharan Dhar Awasthi (*b* 28 September, 1922; *d* 21 August, 2011) obtained MSc degree from Lucknow University, Lucknow. He joined a training programme in Systematic Botany and Taxonomy for 2 years at the Botanical Garden and Herbarium, Kolkata under the auspices of Botanical Survey of India. During this period he got interested in the taxonomic studies of Indian lichens which he pursued throughout his later life. Back to Lucknow, he worked as a Botanical Assistant for about 4 years at the National Botanical Garden, Lucknow which was then under the Department of Agriculture, Uttar Pradesh.

Later he became a Faculty Member at the Botany Department, University of Lucknow and received PhD degree.

Dr Awasthi vigorously pursued taxonomical investigation on Indian lichens for over 25 years. This enabled him to establish a foremost center of lichenological investigations in the country with a well-developed herbarium. Dr Awasthi was a Fellow of Indian Academy of Sciences. He was the recipient of Panchanan Maheshwari Memorial Lecture of INSA and Acharius Medal of the International Association for Lichenology. He had been an Honorary Member of the British Lichen Society since 1993. He was often referred to as Father of Indian Lichenology on account of his pioneering efforts for its development.

Dr Dharani Dhar Awasthi was elected to the Fellowship of Indian National Science Academy in the year 1984.

Vinod Bhakuni



Vinod Bhakuni (*b* 24 May, 1962; *d* 15 July, 2011) obtained his BSc and MSc degrees from Lucknow University after which he joined Central Drug Research Institute, Lucknow where he worked on synthesis and structural determination of phospholipids under the supervision of Dr CM Gupta. From 1989 to 1992 he worked at the Johns Hopkins University, Baltimore, USA as a Post-Doctoral Fellow. Subsequently he returned to India and joined the Molecular and Structural Biology Division of CDRI, Lucknow as a Scientist and was presently heading the Division.

Dr Bhakuni started a Protein Chemistry Laboratory at CDRI, Lucknow where he initiated work on folding and stability of proteins. His research was focused on understanding the role of electrostatic interactions in maintenance of functional activity and structural cooperativity in proteins. Role of cooperativity in design of inhibitors, drug molecules and of enzymes designated as drug targets of Mycobacterium tuberculosis was explored by him.

Dr Bhakuni was a Fellow of Indian Academy of Sciences, Bangalore and National Academy of Sciences (India), Allahabad. He was the recipient of CSIR Young Scientist Award; National Bioscience Award; Raman Research Fellowship; SS Bhatnagar Prize and PB Rama Rao Award.

Dr Vinod Bhakuni was elected to the Fellowship of Indian National Science Academy in the year 2008.

Ajay Kumar Bose



Ajay Kumar Bose (*b* 12 February, 1925; *d* 12 February, 2010) obtained his MSc degree from Allahabad University and Sc.D. degree from MIT in 1950. He conducted the Post-doctoral work at Harvard University and at the University of Pennsylvania.

Bose joined as Associate Professor (1959) and Professor (1963) at Stevens Institute of Technology, NJ, USA and served there throughout his career.

Professor Bose conceived of a new synthesis of *beta*-lactams (an essential structural feature of penicillin antibiotics). He made industries aware of technological advance in instrumentation. He mentored 35 doctoral students and collaborated in his laboratory with about 100 post-doctorals and visiting scientists from various countries.

Professor Bose was a Fellow of the American Association for the Advancement of Science. The Indian Chemical Society gave him a Lifetime Achievement Award in 2006. In 1999 Professor Bose won the US Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring and the Dreyfus Award of the American Chemical Society for encouraging disadvantaged students in careers in chemical sciences.

Professor Ajay Kumar Bose was elected to the Fellowship of Indian National Science Academy in the year 1982.

Mahendra Nath Bose



Mahendra Nath Bose (*b* 03 March, 1925; *d* 27 April, 2011) obtained his PhD from the University of Lucknow. After MSc, he joined research under Professor Birbal Sahni (FRS) as a Personal Research

Assistant. Later he was appointed as a Lecturer in the Birbal Sahni Institute of Palaeobotany, Lucknow and rose to become the Director of the Institute.

Dr Bose's major contribution was on the Mesozoic palaeobotany of India and Palaeozoic palaeobotany and palynology of Zaire. Besides, he had worked on the Lower Cretaceous plants of Arctic region. He had also made significant contributions on fossil Clitellate cocoons. After retirement (1985) he went to Geology Institute, Oslo for about 5 years and worked on *Sciadopitys* like leaves from Arctic region and wrote a paper on Paleozoic-Mesozoic plants from India and Antarctica.

Dr Bose was a Fellow of Indian Academy of Sciences, Bangalore and the Palaeobotanical Society. Among several awards and honours that Dr Bose received are : Ruchi Ram Sahni Award, the Palaeobotanical Society International Medal and Sahni Centenary Medal.

Dr Mahendra Nath Bose was elected to the Fellowship of Indian National Science Academy in the year 1982.



Suresh Chand Jain



Suresh Chand Jain (*b* 05 December, 1926; *d* 10 December, 2009) obtained his PhD degree from Delhi University specializing in Solid State Physics. He was Faculty Member, Physics Department, University of Leeds, UK; Head, Solid State Physics, National Physical Laboratory, New Delhi and Director,

Solid State Physics Laboratory and Defence Research and Development Organization.

Dr Jain developed, under the supervision of KS Krishnan, a new method of measuring thermal conductivity of solids at high temperatures, which become standard as the Jain-Krishnan method. His work on point defects and their aggregation in non-metallic crystals opened up new areas of research. He was a Senior Member, Institute of Electrical and Electronics Engineers, USA. Dr Jain was a Fellow of Institution of Electronics and Telecommunication Engineers (India); Institute of Physics (London) and American Physical Society. He was recipient of SS Bhatnagar Prize.

Dr Suresh Chand Jain was elected to the Fellowship of Indian National Science Academy in the year 1979.

Madhu Sudan Kanungo



Madhu Sudan Kanungo (*b* 01 April, 1927; *d* 26 July, 2011) obtained MSc (Zoology) degree from Lucknow University and was a Lecturer in Ravenshaw College, Cuttack. He initial work on physiology of heart

of scorpion was published in *Nature* that earned him a Fellowship from University of Illinois, Urbana, Illinois, USA for doing PhD under the famous physiologist, Professor CL Prosser. On his return he became Reader in Utkal University and later joined Banaras Hindu University. He was the Head of Zoology Department for two terms in BHU and Dean of Faculty of Science. After superannuation, he was made Professor Emeritus of BHU for rest of his life.

Professor Kanungo was responsible for introducing experimental courses like physiology and biochemistry that helped the Zoology Department of BHU to become the Centre of Advance Studies by UGC. He

founded an Association of Gerontology India in 1981 and was its President (1981-88) and then Patron. He established an Institute of Life Sciences in Bhubaneswar under Government of Orissa and was its Founder Director. He was a member of National Council for Older Persons of Government of India under the Ministry of Social Justice and Empowerment. Professor Kanungo was a Fellow of Indian Academy of Sciences, Bangalore, National Academy of Sciences (India), Allahabad and National Academy of Medical Sciences. He was the recipient of SS Bhatnagar Prize, National Fellowship of UGC, Jawaharlal Nehru Fellowship, INSA Golden Jubilee Commemoration Medal, FICCI Award, Sir Sri Ram Memorial Oration Award of National Academy of Medical Sciences and Padma Shri.

Professor Madhusudan Kanungo was elected to the Fellowship of Indian National Science Academy in the year 1975.

Nuggehalli Raghuvver Moudgal



Nuggehalli Raghuvver Moudgal (*b* 04 October, 1931; *d* 09 May, 2011) obtained his PhD working on biochemistry of thyroid hormones at the University of Madras. He was the Chairman of Department of Biochemistry and Dean, Faculty of Science at Indian Institute of Science, Bangalore.

While in USA, Moudgal studied the immunochemistry of pituitary protein hormones isolated from sheep and human pituitaries. The research interests of his group at IISc was primarily focused on studying the role of LH and FSH in regulating specific events in gonad function of both rodent and monkeys. Pioneering work was carried out on elucidating the role of FSH in regulating spermatogenesis in the adult monkey and based on these results the feasibility of developing a contraceptive vaccine for use in man was also explored. Professor Moudgal's laboratory was recognized as a Centre for Advanced Research in Reproductive Biology by the ICMR.

Professor Moudgal was a Fellow of Indian Academy of Sciences, Bangalore and Member of Society of Biological Chemists, India, Endocrine Society and Society for Studies in Reproduction, USA. He was

recipient of BC Guha Award; SS Bhatnagar Award, Sreenivasayya Award of Society of Biological Chemists; Sanjay Gandhi Award for Science & Technology and Yellapragada SubbaRow Memorial Lecture of INSA.

Professor Nuggehalli Raghuveer Moudgal was elected to the Fellowship of Indian National Science Academy in the year 1978.

Hari Narain



Hari Narain (*b* 21 September, 1922; *d* January 27, 2011) obtained his MSc (Physics) and DPhil from Allahabad University under the supervision of KS Krishnan and PhD (Geophysics) from Sydney University, and DSc from Indian School of Mines, Dhanbad. He

worked as Superintending Geophysicist, Oil and Natural Gas Commission (ONGC), Dehradun, Director, Institute of Petroleum Exploration, ONGC; Director, National Geophysical Research Institute; Concurrently he was Surveyor-General of India and later Vice-Chancellor, Banaras Hindu University.

Hari Narain's initial researches related to studies on crystals and organic molecules by Raman and IR methods. He carried out pioneering surveys on the eastern and central parts of Australia throwing new light on the tectonics and subsurface geological and crustal structures. As Founder Director of NGRI, he established several new research groups on seismology, exploration geophysics, airborne magnetic surveys, geophysical instrumentation, rock mechanics, high-pressure physical properties of rocks and minerals, paleomagnetic laboratory, magnetic observatory, geochemistry, geochronology and geological studies. His work on seismology established new criteria for reservoir associated earthquakes and determined upper mantle structures in and around Indian subcontinent. He had prepared quantitative seismicity maps and heat flow map of India.

He was elected President of the Geology and Geography Section, Indian Science Congress (1972); Indian Geophysical Union (1973-75) and Fellow, National Academy of Sciences (India), Allahabad. Dr Hari Narain won many awards and honours, notably the National Lecturer Award in Earth Sciences by

UGC; Padma Shri; Decennial award by the Indian Geophysical Union; Honorary Professorship by Andhra University; Petrotech Life Time Achievement Award; National Mineral Award of Excellence by Ministry of Mines, Government of India and General President Medal, Indian Science Congress.

Dr Hari Narain was elected to the Fellowship of Indian National Science Academy in the year 1981.

Rabindra Prasad Purkayastha



Rabindra Prasad Purkayastha (*b* 31 August, 1935; *d* January 19, 2011) obtained his PhD degree of the University of London and DIC of the Imperial College in 1965. He had served as Reader (1977), Professor (1986), Professor and Head (1992-94) and Sir Rasbehari Ghosh

Professor of Botany (1995-2000) at University of Calcutta.

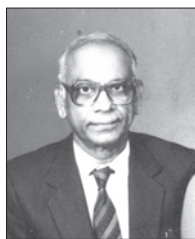
Professor Purkayastha was engaged in teaching for more than three decades. He taught Botany mainly Mycology and Plant Pathology at Visva Bharati University, Santiniketan and University College of Science, Kolkata. Later he specialized in Physiological and Molecular Plant Pathology. Alongwith teaching at Calcutta University he continued his research on phytoalexins (PA) and induced resistance in plants and demonstrated the involvement of PA in differential resistance of rice, jute, broad bean and soybean cultivars to fungal diseases. He had proposed a new concept of phytoalexin, plant antigens (proteins) and disease resistance in plants.

Professor Purkayastha was Fellow of National Academy of Sciences (India), Allahabad and National Academy of Agricultural Sciences. He was also Foundation Fellow of West Bengal Academy of Science & Technology. He was recipient of Paul Johannes Bruhl Memorial Medal (Asiatic Society); Professor SN Dasgupta Memorial Lecture Award (Indian Phytopathological Society); Platinum Jubilee Lecture Award (ISCA) and Eminent Teacher Award (University of Calcutta).

Professor Rabindra Prasad Purkayastha was elected to the Fellowship of Indian National Science Academy in the year 1993.



Vallabhaneni Sita Rama Das



Vallabhaneni Sita Rama Das (*b* 05 February, 1933; *d* December 09, 2010) obtained DPhil (1957) from the University of Oxford, UK working on metabolism of isolated chloroplasts under Professor WO James. Thereafter he worked at the University of Allahabad as Assistant

Professor of Botany, then moved to the Sri Venkateswara University, Tirupati (where he worked upto 1988) as Head of the Botany Department and later as Rector at the Sri Venkateswara University.

Professor Rama Das's doctoral work resulted in isolation of biochemically pure chloroplasts for the first time uncontaminated by the mitochondria. His principal research activity has been in the area of plant physiology covering photosynthesis. He carried out research in relation to foliar solar tracking behavior and photosynthesis. Professor Rama Das developed a strong school of plant physiology particularly in photosynthesis in the Department of Botany at the SV University and a Center for Photosynthesis at the University of Hyderabad

Professor Rama Das was a Fellow of the Indian Academy of Sciences, Bangalore and the National Academy of Agricultural Sciences, New Delhi. He was President of the Indian Society for Plant Physiology (1973). and Andhra Pradesh Akademi of Sciences (1978-79). He was recipient of Outstanding Achievement Biological Sciences Award of FICCI; Birbal Sahni Gold Medal by Indian Botanical Society; JJ Chinoy Memorial Medal by Indian Society for Plant Physiology; JC Bose Award by UGC and Professor SB Saksena Memorial award of INSA.

Professor Vallabhaneni Sita Rama Das was elected to the Fellowship of Indian National Science Academy in the year 1978.

Veronica Filomena Rodrigues



Veronica Filomena Rodrigues (*b* 31 March, 1953; *d* 10 November, 2010) carried out her early education in Nairobi, Kenya and her undergraduate studies at Trinity College Dublin, Ireland. She was awarded BA in 1976 having majored

in the Natural Sciences. She subsequently joined the TIFR, Mumbai as a graduate student. Upon completion of her PhD in 1982, she embarked upon postdoctoral training at the Max-Planck Institut Germany.

While at the Max-Planck Institute, Professor Rodrigues showed that information about odors is encoded as pattern of activation across neurons within the olfactory lobe of *Drosophila*. Upon returning to India she initiated studies aimed at understanding how this circuitry develops and what are the mechanisms that underlie the function. She subsequently worked on how chemosensory circuits develop to allow complex function and what are the ways using which circuits can be modified to adapt to a varying environment.

Professor Rodrigues was a Fellow of Indian Academy of Sciences, Bangalore. She was recipient of the Golden Jubilee Commemoration Medal (Biological Sciences) (2004) of INSA, the National Woman Bioscience Award (2004) and the JC Bose Fellowship (2007).

Professor Veronica Filomena Rodrigues was elected to the Fellowship of Indian National Science Academy in the year 1995.

Gitindra Saran Sanyal



Gitindra Saran Sanyal (*b* 01 February, 1922; *d* 07, July 2011) completed his university education in 1943. He was awarded DSc (*hc*) in 2004 by IIT Kharagpur. After working for two years at All India Radio, he went to UK and obtained advanced diplomas in radio engineering and radar technology.

This was followed by four years of research at Marconi's Wireless Telegraph Co. Ltd. and Pye Ltd., UK. He returned to India to initially join Calcutta University and later IIT, Kharagpur, eventually serving as Director, IIT, Kharagpur and after superannuation continued there in one capacity or another.

Professor Sanyal taught virtually all subjects in electronics and telecommunication except digital communication, computers and solid state electronics. He collaborated with several universities and research laboratories in the US and made significant contributions in the areas of electromagnetics, microwave antennas, phased array radars, optical and

fibres and many ancillary problems on radio physics and electronics. His untiring efforts led to the establishment of Radar and Communication Centre sponsored by DRDO at IIT Kharagpur. His keen interest in the use of technology for rural uplift and rural health care through the IIT Mission Project throw light on his commitment to social welfare. Professor Sanyal was a Fellow of Indian National Academy of Engineering, Instrumentation of Electronics and Telecommunication Engineers and Institution of Engineers (India). He was the recipient of PC Mahalanobis Medal of INSA and Life Time Contribution Award by Indian National Academy of Engineering.

Professor Gitindra Saran Sanyal was elected to the Fellowship of Indian National Science Academy in the year 1976.

Foreign Fellows

Robert Harza Burris

Robert Harza Burris (*b* 13 April, 1914; *d* 13 May, 2010) obtained his Ph.D. in 1940 from University of Wisconsin, Madison, USA specializing in Biological Nitrogen Fixation and Plant Biochemistry. Burris introduced the use of ¹⁵N as a tracer in studies of biological nitrogen fixation. He established that the ammonium ion is the key intermediate in biological nitrogen fixation; demonstrated that nitrous oxide, azide and acetylene are substrates for nitrogenase, and this led to the use of acetylene for testing nitrogenase activity; demonstrated the role of ATP as the energy source; described how hydrogen functions as a specific, competitive inhibitor of nitrogenase; demonstrated that the nitrogenase. He served as Professor & Chairman at Department of Biochemistry, University of Wisconsin, Madison, USA.

Professor Burris was Member of American Society of Biochemistry and Molecular Biology; Fellow National Academy of Sciences, USA; American Academy of Arts & Sciences; American Philosophical Society; American Society of Plant Physiology (President 1960)

American Association for the Advancement of Science; Member, American Chemical Society, Biochemical Society and American Society of Microbiology. He was recipient of number of awards some of them are Stephen Hales Award and Charles Reid Barnes Award of American Society of Plant Physiology; Merit Award of Botanical Society of America and Spencer Award of American Chemistry Society.

Robert Harza Burris was elected to the Foreign Fellowship of Indian National Science Academy in the year 1986.

Har Gobind Khorana

Har Gobind Khorana (*b* 09 January, 1922; *d* 09 November, 2011) obtained PhD in 1948 from University of Liverpool, USA specializing in Molecular Biology, Biochemistry and Enzymology and DSc (*h.c.*) from ten universities. Khorana's initial work dealt with the preparation of *m*-RNA strands of defined nucleotide sequence. Using the enzyme RNA polymerase and chemically synthesized DNA template, he could get long chains of RNA as a result of repeated replication by the enzyme; this, he realized, was an ideal method for replication and employed it for the production of high-molecular weight deoxyribonucleotides of known sequence using DNA polymerase. Later, Khorana was able to synthesize an entire gene complete with appropriate punctuation codes for defined initiation and precise termination.

Professor Khorana was the recipient of number of awards some of which are : Nobel Prize for Medicine or Physiology (1968); Merck Award of Chemical Institute of Canada; Gold Medal of Professional Institute of the Public Service of Canada; American Chemical Society Award for Creative Work in Synthetic Organic Chemistry; American Academy of Achievement Award; J.C. Bose Medal of Bose Institute, Kolkata; Padma Vibhushan (1972) and Order of San Carlos, Government of Columbia.

Professor Har Gobind Khorana was elected to the Foreign Fellowship of Indian National Science Academy in the year 1972.



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News about Secretariat

Retirement



Smt Davinder Kaur had joined the Academy on 20th September 1977. She took voluntary retirement as Section Officer III from the services of the Academy on 12th September 2011. During her tenure, she worked for the Administration and ICSU sections of the Academy.



Smt Geeta Jaitley superannuated from the services of the Academy on 31st December 2011 as Assistant of the Academy. She had joined the Academy on 5th December 1979. During her tenure, she worked for the Inter-academy, ICSU, Science Promotion and Administration sections of the Academy.



Smt Darshan Dang superannuated from the services of the Academy on 31st December 2011 as Assistant of the Academy. She had joined the Academy on 27th August 1979. During her tenure, she worked for the Publication, Account and Administration sections of the Academy.



ANNOUNCEMENTS

Proceedings of the Indian National Science Academy Invitation to Authors

Proceedings of the Indian National Science Academy is an inter-disciplinary journal devoted to publication of review papers, original research articles, short communications, commentaries, lateral thinking and emerging techniques in the areas of Physical, Biological, Applied Sciences and also Engineering. Four issues of the Journal are published in March, June, September and December.

Three copies of the manuscript complete with figures, tables and any other material (one original and two copies) may be submitted to the Editor-in-Chief, *Proceedings of Indian National Science Academy*, Indian National Science Academy, Bahadur Shah Zafar Marg, New Delhi 110002. A copy of the manuscript may also be submitted in the electronic form at procinsa@insa.nic.in.

History of Science

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