

The importance of NRIs

Murukesapillai's correspondence¹, which refers to an editorial in *Current Science*², and which comments on the role of NRIs in the development of India, is interesting. It is true that some, if not all, NRIs usually have a sentimental relationship with this country because the majority of their kith and kin lives here. But this does not mean that they would have a special desire to do something for the welfare of the Indian society. That is simple to understand. Persons having no hesitation in deserting the land of their birth in search of better jobs, better opportunities and better living conditions, and persons having even long-term plans of accepting the citizenship of a foreign land, cannot be expected to be more concerned about and more enthusiastic to serve the country of their origin compared with the natives. That some of them part with good donations cannot be taken as testimony of their concern. Since they are financially in a good position – and it is said that a US resident Indian has higher average income than a person from any other ethnic group – they can donate well. Because of the currency exchange rate, even a small donation can turn out to be a big sum in this country.

It is not always true that Indians go to the US (and for that matter any other developed country) because they cannot find a job here. In recent past, three of my colleagues left for the US, resigning their permanent positions in my university department. In fact, leaving for the US and getting a permanent residence in that country is for many Indians, a dream

come true. This simply means that the feeling of nationalism is not as strong as some of us would like to believe. Yet, most of us would not leave the country, not because of a strong bond with the country itself, but because of certain constraints like that of family relations and of difficulty in adjusting to an alien society. National allegiance is a weak concept and in this age of globalization, it has grown weaker. Rampant corruption in the society is an irrefutable proof in this respect.

Then why is so much importance being given to NRIs, with the government even celebrating Pravasi Bharatiya Divas? Does this mean that one could serve the country better by becoming an NRI? Perhaps, this is related with the foreign obsession that is so deep-rooted in the Indian psyche. The successful English rule of about two centuries over this country coupled with the undeniably impressive technological advancements in the West during the same period, had a blinding effect on the Indian people. Any intellectual concept or any material object that originates in the West is considered necessarily superior to whatever is indigenous. Even after getting political independence, intellectual slavery continues to rule over our minds. During all these years, westernization of the Indian educated mass has been a consistent process, aided definitely by the electronic and print media. We are living with borrowed concepts. Be it the political system (democracy), the economic system, the judiciary, the education, or the medical system,

almost everything is imported from the West. The concepts of globalization and liberalization that we have accepted in recent times have also originated in the West. After an initial hesitation or confusion, we generally adapt ourselves to every new idea originating in the West, without questioning its relevance or utility in the light of our different social, cultural and economic background.

Our academic system is not free from this influence. We consider a foreign course of study to be superior to ours. We accept without a pause, any research front that opens up in the West. A paper in a foreign journal is more respectable. A piece of work published in a foreign journal, a thesis evaluated by a foreign examiner, and a testimonial from a foreign scientist are all accepted as trustworthy. So also, an NRI is believed to be superior to his/her counterpart in India. And so on. No wonder then that some of us regard NRIs as our saviors–rescuers in periods of academic crisis.

1. Murukesapillai, K., *Curr. Sci.*, 2003, **84**, 1383.
2. Balaram, P., *Curr. Sci.*, 2003, **84**, 121–122.

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NEWS

Fourteenth mid-year meeting of the Academy*

The high point of the 14th Mid-Year Meeting of the Indian Academy of Sciences, Bangalore was that for the first time, part of the sessions was held at Bangalore University, i.e. outside the Indian

Institute of Science (IISc) campus. A 500-strong auditorium at the University was filled to the brim with eager questions put by the young and old alike, and subsequently, the IISc venue was filled with more youth and invited teachers. K. Kasturirangan, President of the Indian Academy of Sciences, inaugurating the special half-day session on genetics to

commemorate '50 years of discovery of the double helical structure of DNA', described the celebration as significant for this seminal discovery. Kasturirangan said that holding sessions outside IISc would 'become a pattern for future Mid-Year meetings'.

G. Padmanaban, IISc, Bangalore, delivered a special lecture on 'Molecular

*A report on the 14th mid-year meeting of the Indian Academy of Sciences, Bangalore held during 17–19 July 2003 in Bangalore.

medicine'. Gene therapy may be used for treating a variety of diseases such as genetic disorders, cancers and cardiac myopathies. This has now progressed into the human trial stage of development. Molecular medicine involves taking the important macromolecules produced by the human body for treating human diseases. Cancer-antisense therapy, vascular gene therapy, possible vaccines for tumour and stand-alone DNA vaccines that could be cheap and do not require a cold chain, a major factor in transportation of vaccines, would be beneficial. Padmanaban said that the first rabies vaccine could be out in the Indian market within six months. At this point of time, it is yet not understood how to replace a defective gene, although the principle for using genes has been developed. Problems do exist, for example, 'in efficiency of gene delivery and sustained expression of the gene product, unexpected side effects and ethical issues that have still to be sorted out', said Padmanaban, 'before molecular medicine could become regular clinical practice'.

With a catchy title, 'Cryptic genes: a case of the dog that did not bark', S. Mahadevan, IISc, pointed out that many bacterial genomes such as those in *Enterobacteriaceae* hold out genes that have functions, but are not expressed during the life cycle of the organism. The potential for expression or activation of these otherwise dormant or cryptic genes is by a genetic event such as mutation, transposition or recombination. Sometimes these are expressed with the acquisition of a new phenotype. How exactly these quiet yet expressible genes live silently over evolutionary timescales, is unknown. Mahadevan has attempted to crack this puzzle by looking at, for example, the silent beta-glucoside (*bgl*) genes of *Enterobacteriaceae* and then studied genes that do not have this property of being silent in *Escherichia coli*, *Shigella* and *Klebsiella*. The results from this investigation indicate that such *bgl* genes are generally conserved. 'An elevated expression during the stationary phase, suggests their involvement in stress induced by starvation with evolutionary implications,' according to Mahadevan.

Arjula Reddy, University of Hyderabad has sought to find answers to the problem of 9.9 million tonnes of grains lost annually due to drought, with particular interest in the rice crop, using a genome-wide approach for understanding how rice genes respond to changes

in the environment, especially drought tolerance in rice. He cautioned that agricultural operations consume 75% of the total freshwater resources of the country, of which rice consumes 70% during its cropping cycle. Considering that rice is a major crop in India, this could have ramifications in the future when people face a constrained water budget. In this quest, his research group has developed DNA markers, studied molecular mapping, map-based gene isolation, sequence characterization, etc. Extending this mapping, his group at the university has done comparative gene sequencing between sorghum and rice. Their successes also include, systematic identification and isolation of target genes, generating more than 10,000 ESTs from a normalized cDNA array library from drought-stressed seedlings of rice, depositing at least 6000 ESTs in GenBank. Identification of over 400 stress-responsive genes and construction of more than 300 SSR markers have all been made possible with the availability of the draft rice genome sequence in the public domain.

Bombyx mori or the silkworm has been a research passion for J. Nagaraju, Centre for DNA Fingerprinting and Diagnostics (CDFD), Hyderabad. India is home to 6 million people who depend on the silkworm for their livelihood. Nagaraju's research is a way for Indian silkworm farmers to improve their economic prospects in the global marketplace, among about 55 silk-producing countries. For this, Nagaraju has detailed traits of both tropical and temperate silkworms. The main point to note is that tropical worms produce poor-quality silk but are resistant to viral attack, whereas temperate worms, producing longer, superior quality silk fibre, have a drawback of not being resistant to viruses. Virus attack could damage about 15% of silk cocoon production annually. Therefore, the major emphasis of Nagaraju's research has been to create new high-yielding, virus-resistant strains adapted to Indian conditions, and in addition, a few strains that could produce certain pharmaceuticals through selective breeding and genetic manipulation. At CDFD, scientists have identified more than 350 microsatellite loci in *B. mori* and transgenic silkworms have been obtained that have resistance to baculoviruses. Another offshoot of this work is that since the silkworm belongs to the Lepidoptera family of destructive agricultural pests, any genetic research could

aid in further understanding of this pest menace and thereby provide a means for their eradication through genetic engineering. Nagaraju has identified important genes of wild silkworm that serve as targets for Lepidopterous pest species.

Pijush K. Das, Indian Institute of Chemical Biology, Kolkata has looked at kala-azar, prevalent mainly in parts of Bihar and West Bengal, in producing parasite *Leishmania donovani* for identifying a neuronal-type calcium ion-stimulated nitric oxide synthase (NOS) for understanding the intracellular calcium-ion level in the regulation of guanylate cyclase activity. Infectivity by this lower eukaryotic parasite has been studied and comparison with the kinetics in higher eukaryotes has been done. His biochemical research has revealed that the guanylate cyclase enzyme is calcium ion-modulated and nitric oxide-insensitive, as opposed to higher eukaryotes. This work has provided an important link between the enzyme, calcium content, virulence of the disease and signalling pathways.

The talk on 'Conscious evolution of proteins' by Anand Ranganathan, International Centre for Genetic Engineering and Biotechnology, New Delhi enthused wide interest in a mixed audience, signifying that understanding proteins and their potential in various life-processes and in the pharmaceutical industry continues to pose new challenges. Ranganathan has embarked on exciting experimental research in the last couple of months that would assemble codons, mix them together adding requisite enzymes to design an astronomical number of proteins using simple mathematical rules applicable to DNA. One use of this technology could be a method to generate signal peptides, according to Ranganathan.

At IISc, Kasturirangan briefed the Fellows about the new Academy Guest House at Jalahalli, the Committee on Scientific Values that has already begun its deliberations and also the Committee on the Role of Women in Science.

The Academy's first special lecture was delivered by J. P. Mittal, Bhabha Atomic Research Centre, Mumbai on the excitement in radiation research that deals with ionizing radiations such as X-rays, gamma-rays and high-energy charged particles. Significant among these is the study of 'the hydrated electron' – a potent reducing species, known since about a decade, using pulse radiolysis techniques. Radiation research could be important in

the understanding of antioxidants, redox reactions and the preparation of special polymeric materials, biological hydrogels and formation of colour centres in gems such as diamonds. The Department of Atomic Energy has for several years been instrumental in providing facilities for irradiation of food and spices. Irradiation is especially useful in sterilization of medical products, as also in the hygienization of municipal waste. A Sludge Hygienization Research Irradiator Facility has been set up at Vadodara. The sludge is treated to remove the harmful pathogens present with an optimal dose of radiation. The treated sludge could then be used as a biofertilizer. Radiation research attempts to understand a variety of systems at the molecular level before benefits of this research reach the people.

U. K. Mishra, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow said that Japanese encephalitis continued to be a challenge, endemic to South-East Asia. His work has revealed that high-frequency thalamic involvement in Japanese encephalitis using magnetic resonance imaging (MRI) is a diagnostic test prior to obtaining virological test results. Mishra has also investigated the role of thalamus in Japanese encephalitis in the genesis of movement disorders on the basis of MRI tests.

S. Ramakrishnan, Tata Institute of Fundamental Research (TIFR), Mumbai spoke on 'the coexistence, competition of charge density wave with superconductivity or magnetism in $\text{RE}_5\text{Ir}_4\text{Si}_{10}$ compounds' and said that this compound series offers a new and extremely convenient paradigm with which to study strong coupling charge density wave and coexisting superconductivity or magnetism.

Anil Kumar Singh, Indian Institute of Technology (IIT), Mumbai described photobiological switches wherein shape change in the retina can trigger vision disorders. Caged compounds, wherein covalent linking of a bioactive molecule to a photocleavable group can be introduced into cells, and then depending on requirement can be rapidly regenerated by photo-irradiation are useful in studying a wide range of cellular activities. The key for their usefulness in biological systems is that the cage needs to be photocleavable under physiological conditions and in the range of wavelengths that is harmless to the system. One example of such a study is the use of a nitrona-

phthyl chromophore and the corresponding immunoglobulin bioconjugate.

Rahul Mukerjee, Indian Institute of Management, Kolkata described orthogonal arrays as an elegant combinatorial structure related to Latin squares that have several applications.

A new approach has been undertaken by Shobhona Sharma, TIFR, Mumbai in relation to understanding acquired immunity to malaria. People living in endemic areas of India such as in Orissa, with the absence of the clinical disease, have been taken up for this study. Sharma, using a differential immunoscreen, has identified some of the protective malarial antigens of the human malarial parasite, *Plasmodium falciparum*. Many of these conserved proteins and antibodies against them are to be found only in malaria-immune people. Studies are in progress for eventually mimicking these malaria-protective agents that could be used to cure the disease, especially due to increased drug resistance seen in malaria. It could take a long time before this kind of therapeutic approach is used.

Anurag Sharma, IIT, Delhi gave a historical insight into guided wave optics and the recent progress made in the field of wave-propagation methods. Sharma has developed a collocation method for numerically solving the propagation equations.

Rajiv V. Gavai, TIFR, Mumbai unraveled the theory of strong interactions, namely quantum chromodynamics, with reference to the occurrence of quark-gluon plasma phase transitions which could have been significant to our universe after the big bang. Such plasma could be created, given appropriate conditions, with high-energy, heavy-ion collision experiments at Brookhaven National Laboratory, USA or at CERN, Geneva, according to Gavai.

G. Venkateswara Rao, Vikram Sarabhai Space Centre, Thiruvananthapuram enumerated the importance of finite element method for gaining a handle on determining the accuracy of results and correlation between analysis and testing of complex structures in real-life engineering situations. This user-friendly method is useful in bridging the gap between anomalies that exist in accurate theoretical predictions and well-calibrated tested values, with error bars being as high as 5–10%, especially with regard to complex geometries, loading and boundary conditions. This method provides infor-

mation about displacements and strains, as structures are designed for a given configuration and a given input of load-bearing.

Key attributes of novel, amorphous, alumina-based ceramics that exhibit metal-like plastic flow at temperatures was explained by Vikram Jayaram, IISc. These ceramics such as alumina-zirconia are useful in making cutting tools that are tough and wear-resistant. Jayaram spoke of a simple yet useful synthetic method wherein powders of alumina and zirconia are pressed at about 900 MPa and a temperature in the range of about 600–700°C, yielding fully dense materials that behave like metals. Also, he has devised a method, using experimental conditions of temperature of nearly 650°C and a pressure of 750 MPa for about 1 h, for embedding a hard matrix such as silicon carbide into a soft matrix, with numerous potential applications for the fabrication of hard and tough composites with ultra-fine structures in a new class of systems.

How severe acute respiratory syndrome (SARS), much talked about in recent months, has turned out to be the first global epidemic of this century that cut across international boundaries, mainly travelling on aeroplanes, frightening people and governments to take rapid action for containing the virus, was the subject of the public lecture by Indira Nath, All India Institute of Medical Sciences (AIIMS), New Delhi. She pointed out the clinical features, the causative factors and statistics of the disease while emphasizing how research data on SARS have been shared and prompt measures enforced through international cooperation on an unprecedented scale, auguring well for humankind, but reasserting the importance of good public-health policies. Economies of both rich and poor countries have been affected by SARS. In a lively discussion that followed, an important point raised by the audience was the necessity for a detailed study on whether Indians had some immunological immunity to this particular virus, that had kept Indians, who worked in some high-risk areas during the epidemic, unaffected.

Although the 'Dinosaurs of India' have since nearly 65 million years ago, become extinct, it was a house-full audience that listened to Ashok Sahni of Panjab University, Chandigarh who showed how these creatures still continued to evince keen interest among both scientists and the public, going by the number of

questions put to the speaker. Sahni showed how the study of dinosaurs could provide valuable insights into thermal insulation, throw light on the evolution of birds and mechanism of bird-flight, their possible origins and the first report of the remains of an Indian dinosaur in the year 1828 from Jabalpur. Although Jurassic specimens have been preserved and are on display at the Indian Statistical Institute, Kolkata and the Birla Science Centre, Hyderabad, Sahni spoke of the vandalism at the Dinosaur National Park near Ahmedabad. He implored the scientific community to assist in the preservation of rare dinosaur fossils, nests and eggs in the interest of palaeobiology. Even dinosaur dung could reveal isotope features, indicating the digestive physiology such as ingestion of pollen and diatoms, of the now-extinct herbivorous sauropods, which had lumbered across our land at the speed of 20–25 km/h. Other than the Deccan region of India, dinosaur fossils have been located in some parts of Meghalaya and in Tiruchirapalli.

Transition metal chemistry dealing with phosphonates and stannoxanes wherein P–O and Sn–O motifs have been used to generate large scaffolds in the molecular assembly of transition metals is the research work of V. Chandrasekhar, IIT, Kanpur. He has been able to synthesize hexameric ferrocene assemblies like a wheel around a central core made up of a stannoxane framework. His group has christened this as a 'rangoli with tin drums'. These new supramolecular architectures show tunability of redox centres and both thermal and electrochemical stability.

Conventional high-resolution nuclear magnetic resonance (NMR) is routinely used to study the structure of molecules. Extending this technique to more complex systems such as *in vivo* magnetic resonance (MR) spectroscopy of living systems provides useful and early detection in the case of breast cancers, with low price tags such as the facility available at AIIMS, New Delhi according to N. R. Jagannathan, physicist-turned-biomedical researcher. MR imaging gives high-reso-

lution anatomical pictures with superior soft-tissue contrasts, and manipulating the RF field provides different views such as sagittal and axial of the tumour area. Similarly, MR imaging is useful in stroke patients, coronary artery imaging and imaging of the whole spine that takes just about 5 min. Rat models are made use of for studying the effect of herbal drugs in heart diseases and research is in progress for a combination of electrophysiology and MR imaging at AIIMS. There are about 320 MRIs in the country today, with Delhi having 27 of them and six in the vicinity of AIIMS, added Jagannathan. Another technique, *in vivo* MR spectroscopy is used to probe metabolism at the molecular level, efficacy of vaccines, concentration of metabolites, pharmacokinetic studies, amino acid concentrations and level of lithium in psychiatric patients and also for studying variation of choline, a marker, as a function of chemotherapy cycles in breast-cancer patients. Above all, the usefulness of both MR imaging and MR spectroscopy is that they are both high-resolution techniques and are non-invasive. Mammography remains an important tool for breast-cancer detection, but could lack sensitivity in certain patients. MR imaging could be far more effective, especially if the present sensitivity levels of about 80% are further increased.

Subrata Sinha from AIIMS, New Delhi is working on tumour suppressors in human glioma, the commonest of all brain tumours that kills young adults. Sinha has studied the biochemical aspects of the different grades in this variety of tumour originating from astrocytes, such as the tumour suppressor genes, particularly the *p53* gene, cell proliferation, molecular markers for phenotypic parameters and other features.

B. C. Das, Maulana Azad Medical College, New Delhi has developed a novel and simple 'paper smear' method for dry collection, transport and storage of cervical cytological specimens for rapid screening of human papillomavirus (HPV) infections using a single-step DNA ex-

traction procedure. HPVs are the major pathogens associated with the development of cancer of the uterine cervix that is the most common malignant tumour found in women all over the world. In India, about 100,000 women develop this cancer every year, among which 98% test positive for HPV, contributing to about 16% of the global annual incidence. Patients with high risk HPVs could benefit from this test, thereby facilitating early diagnosis before developing cervical cancer. At present, a pap test or a papanicolaou smear test is generally employed but is not fully reliable, added Das. His technique has the ease of collection of samples, i.e. cervical scrapes on a 3 mm Whatman filter-paper slide, air-dried and stored at room temperature, which may then be easily transported from the field to the laboratory and could be particularly of use in large-scale population screening. Generally, biological specimens require more stringent storage conditions such as storage at -70°C or in liquid nitrogen until further processing. Work on a diagnostic kit based on this technique is in progress, according to Das.

'Designer molecules based on sugar amino acids' was the title of the talk by Tushar K. Chakraborty, Indian Institute of Chemical Technology, Hyderabad. Sugar amino acids are useful as conformationally constrained templates comprising rigid furan or pyran rings that are introduced into a polypeptide chain, providing a non-peptide scaffold. These sugar amino acids are easy to incorporate via usual solution or solid phase peptide synthesis, but additionally lend valuable properties to the peptide chain that are under investigation by Chakraborty's research group.

The Fourteenth Mid-Year Meeting of the Academy ended with the presentation of the basic problems on topological and algebraic classification of principal bundles on algebraic varieties by Yogish I. Holla, TIFR, Mumbai.

Nirupa Sen