58th Annual Meeting

At the invitation of the Physical Research Laboratory, the 58th Annual Meeting of the Academy was held at Ahmedabad from 6 to 9 November 1992. The meetings were held at the Physical Research Laboratory (PRL) and the Space Applications Centre (SAC) and were organized by PRL, in cooperation with SAC, the Institute for Plasma Research (IPR) and the Ahmedabad Textile Industry Research Association (ATIRA).

The Meeting began with the inaugural session on the morning of Friday, 6 November at the Physical Research Laboratory (PRL) Auditorium. Prof. R K Varma, Director, PRL, welcomed the delegates to the historic city of Ahmedabad with its many institutes and the richness and diversity of its culture. The last meeting of the Academy held at Ahmedabad was in 1968 under the Presidentship of Professor Raman. The holding of the meeting at PRL he considered to be appropriate as Professor Raman had laid the foundation stone of PRL in 1952 and has inspired many young scientists down the years.

Prof. R Narasimha, President of the Academy in reply said that the Academy was glad to be back again in the home of Mahatma Gandhi, Vikram Sarabhai and Space Research. He next introduced the Fellows and Associates present to the audience - a time-honoured custom established by the Founder-President. He then delivered the Presidential address on “Turbulence on computers”.

The first session was a Discussion Session on “The State of Support for Basic Science in India”. An article on “Basic science: Where do we stand in India?” with contributions from C N R Rao, G Padmanaban, Goverdhan Mehta, Vinod K Gaur, T V Ramakrishnan and R A Mashelkar had been published in Current Science and advance copies of this article were distributed after the discussion session which was presided over by R Narasimha and during which a number of Fellows spoke, including C N R Rao who spoke of the need to make our science and technology globally competitive and for a national strategy for science and technology. The general consensus was that the scientific community should take steps to see that the government instead of providing decreased funding increases its support.

The J B S Haldane Centenary Symposium was held in the afternoon of Friday, 6 November under the chairmanship of Sharat Chandra. A brief report of the symposium is given in this issue.

The Evening Lecture on 6 November was by K Kasturirangan on “Some interesting problems in the development of ISRO satellites”.

The second symposium on “Interactive processes in the near-earth environment” was held on the morning of Saturday, 7 November under the chairmanship of S P Pandya. In his introductory remarks, R Narasimha spoke of Prof. K R Ramanathan’s pioneering work in the near-earth environment (Prof. Ramanathan’s birth centenary is in 1993). A brief report of the symposium is given in this issue.

There were five lecture presentations by Fellows and Associates in the afternoon session, under the chairmanship of S S Jha.

The eternal quest of the physicists has been for the ultimate, most fundamental building blocks of matter. The theorists have given a very satisfactory description of the elementary particles, and experimentalists have detected all except two of them. Naturally, the excitement now is in detecting these elusive players, and gigantic machines (colliders) have been constructed, where charged particles with very high energies collide and set the stage for the particles to be produced. And here, something unexpected happens. Rohini M. Godbole from
Bombay University gave a very exciting account of how these electrons produce particles of light, also of very high energy, which in turn collide amongst themselves. Such studies not only demand improvements in the design of the giant machines, but hint at newer kinds of machines where light collides against light to give us a more enlightened understanding of the matter and energy.

At the other extreme, physicists study very large stars, with gravitational fields so strong that even light cannot escape from them - 'the black holes'. Characteristically, the great Stephen Hawking has shown how something can still come out from the black holes. How does one solve this paradox? Spenta R Wadia from Bombay (TIFR) brought in string theory (the theory that explains everything!) on the scene and used an ingeniously wonderful analogy - that of a one-dimensional fluid - to throw light on the issue.

Coming to chemistry, one finds that it is being done more and more using computers, and less with flasks and chemicals. J Chandrasekhar of the Indian Institute of Science gave a very interesting illustration of the variety of theoretical and computational methods he had used in explaining the shapes and reactivities of organic molecules. Such investigations have often given new insights towards designing of newer molecules with novel properties.

Using three-membered rings of carbon as the starting point, and adding boron, silicon and transilicon metals such as iron in unexpected ways, E D Jemmis of Hyderabad University gave a remarkable illustration of the variety of things a chemist can conjure up from even the simplest of systems, in his talk on 'Three-membered rings and three-membered rings: Tips from boron'.

The last speaker was Asis Datta of Jawaharlal Nehru University, New Delhi on 'A step towards developing transgenic plants with high nutritional quality'. He spoke on the recent achievements of his group in the identification and molecular cloning of a gene from *Amaranthus* that encodes a seed protein rich in the amino acids essential for human nutrition. He also described the cloning of the gene for oxalate decarboxylase, and discussed the potential for use of this enzyme in agricultural and medical biotechnology.

The Evening Lecture on 7 November was by Dr S R Rao, National Institute of Oceanography, Goa on 'Gujarat through the ages'. A summary of his lecture is reproduced in this issue.

A visit to the ancient city of Lothal, 84 km south of Ahmedabad, was arranged in the forenoon of Sunday, 8 November. The period of Lothal is supposed to be from 2450 to 1900 B.C. and the site was discovered in 1954. S R Rao himself showed the delegates round the site of the excavation.

A visit to the Space Applications Centre was arranged in the afternoom, after which there were three lecture presentations by Fellows under the chairmanship of G Mehta.

S Dattagupta, Jawaharlal Nehru University, New Delhi opened the afternoon session with his talk on "Dynamics of supercooled liquids" explaining the unusual increase in viscosity of supercooled liquids. This is attributed to the local orientational order/disorder described in terms of locally ordered cages with an orientational order parameter. The coupling of this with the viscoelastic modes of the liquid explains the enhanced viscosity.

S Ramasesha of the Indian Institute of Science, Bangalore, the next speaker in his talk on "Correlated electronic structure of conjugated systems" discussed the electronic structure of conjugated systems such as polyenes and poly paraphenylenes obtained using the Hubbar-PPP model. The electronic state, the linear and nonlinear optical and magnetic properties are better explained from these calculations.

S R Shenoy of the University of Hyderabad, Hyderabad who spoke last on "Disorder parameter description of phase transitions" generalized the idea of disorder parameter or topological excitations (vortex loops) from two to three dimensions in planar ferromagnets. The cross-over from three to two dimensions in the case of weakly coupled layers was considered. A possible future application could be to layered high temperature superconductors.

The Business Meeting of Fellows was held in the Space Applications Centre Auditorium late in the evening on 8 November. There were brief talks by P K Kaw on Fusion and the urgent need to develop fusion technology, by J Gowrishankar on DNA fingerprinting, K S Yajnik on computer simulation and by P R Pisharoty on Prof. K R Ramanathan.

There were six lecture presentations in the forenoon session of Monday, 9 November. The first three talks were chaired by N K Notani and the last three by Indira Nath. A M Kayastha, Banaras Hindu University, Varanasi spoke on "Studies on beta-subunit of tryptophan synthase from *Salmonella typhimurium*", J B Udgaonkar, Tata Institute of Fundamental Research, Bombay next spoke on "Protein folding: Studies on barstar". He was followed by J Gowrishankar,
Centre for Cellular and Molecular Biology, Hyderabad on "How do organisms cope in environments of low water activity? Some answers from Escherichia coli". P S Goel of ISRO Satellite Centre, Bangalore spoke on "Attitude control of Indian satellites: Challenges met through innovations".

The next speaker was M Vidyasagar of the Centre for Artificial Intelligence and Robotics, Bangalore on "Artificial neural networks: Some recent results." Artificial neural networks are an active area of current research, as they may perhaps be capable of solving some problems the conventional computers find difficult to solve. He explained how neural networks can be used to solve the problem of "algebraic block coding". He concluded by saying that there are some advantages to using analog rather than discrete neural networks, in solving this problem at least.

The last speaker was Gomathy Gopinath of All India Institute of Medical Sciences, New Delhi on "Brain repair". Brain is the most complex of all biological organs and enjoys a unique status in the body. Despite the restricted regenerative capacity of the adult brain, recent experimental results have shown that a region of the mammalian brain undergoing development can be grafted on to the brain of another animal, giving new hope to millions suffering from neurodegenerative diseases.

The Annual Meeting came to a close with concluding remarks by the President. There was a delightful evening of music and Kathak dance on November 7 by Kumudini Lakhia and her troupe.

One hundred Fellows, six Associates and thirteen invitees attended the Meeting. The group photograph taken at PRL on November 7 is reproduced on pages 7 and 8.

The organization and arrangements for the scientific meetings, cultural event and the visits to Lothal and SAC were superb. The Academy is grateful to the Physical Research Laboratory particularly R K Varma, Director, PRL, to the Institute for Plasma Research and its Director P K Kaw, to the Space Applications Centre and its Director Pramod Kale, for making the meeting the splendid success it was. Our special thanks are due to H Sharat Chandra and B H Subbaraya for organizing the two symposia.

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Honorary Fellow elected in 1992

Bernard Raveau, ISMRa, Laboratoire CRISMAT, Université de Caen, Caen Cedex, France

Fellows elected in 1992

V Arunachalam, Indian Agricultural Research Institute, New Delhi, for his contributions in plant genetics

Asha Mathur, King George’s Medical College, Lucknow, for her studies in medical virology

R K Banerjee, Indian Institute of Chemical Biology, Calcutta, for his work in enzyme and membrane biochemistry

R Bhatia, Indian Statistical Institute, New Delhi, for his contributions in operator and matrix theory

S K Bhatia, Indian Institute of Technology, Bombay, for his work on reaction and transport in chemical engineering

J K Bhattacharjee, Indian Institute of Technology, Kanpur, for his theoretical studies of nonlinear phenomena in condensed matter

B Bhattacharyya, Bose Institute, Calcutta, for his contributions in the biochemistry and biophysics of proteins

S P Bhattacharyya, Indian Association for the Cultivation of Science, Calcutta, for his studies in quantum chemistry, particularly of reactions

V S Borkar, Indian Institute of Science, Bangalore, for his work on stochastic control problems in electrical engineering

P Chaddah, Centre for Advanced Technology, Indore, for his contributions in low temperature physics

N Chandrakumar, Central Leather Research Institute, Madras, for his work in chemical physics, particularly magnetic resonance

V R Choudhary, National Chemical Laboratory, Pune, for studies of catalysis in chemical engineering
G R Desiraju, University of Hyderabad, Hyderabad, for his contributions in chemical crystallography

K Dharmalingam, Madurai Kamaraj University, Madurai, for his work in genetic engineering

K N Ganesh, National Chemical Laboratory, Pune, for his studies in bio-organic chemistry

Gopal Krishna, National Centre for Radio Astrophysics, Pune, for his contributions to extragalactic astronomy

M S Jairajpuri, Aligarh Muslim University, Aligarh, for his contributions in zoology, particularly in nematology

Kamala Krishnaswamy, National Institute of Nutrition, Hyderabad, for her studies in nutrition and toxicology

R K Kaul, The Institute of Mathematical Sciences, Madras, for his work in theoretical high energy physics

A V Krishna Murty, Indian Institute of Science, Bangalore, for his contributions in structural engineering, particularly solid mechanics

A K Lala, Indian Institute of Technology, Bombay, for his studies in membrane biochemistry

N C Mandal, Bose Institute, Calcutta, for his work in genetics and molecular biology

C K Mathews, Indira Gandhi Centre for Atomic Research, Kalpakkam, for his contributions in high temperature chemistry

V B Mehta, Tata Institute of Fundamental Research, Bombay, for his studies in algebraic geometry

N Mohan Kumar, Tata Institute of Fundamental Research, Bombay, for his work in algebraic geometry

U C Mohanty, India Meteorological Department, New Delhi, for his contributions in dynamical meteorology and numeric weather forecasting

P Mohanty-Hejmadi, Utkal University, Bhubaneswar, for her studies of differentiation in zoology

V M Nadkarni, National Chemical Laboratory, Pune, for his work in polymer engineering

K A Natarajan, Indian Institute of Science, Bangalore, for his contributions in extractive metallurgy

G P Pandey, National Chemical Laboratory, Pune, for his studies in photochemistry

K N Pathak, Panjab University, Chandigarh, for his work in the physics of the liquid state

R Ramaswamy, Jawaharlal Nehru University, New Delhi, for his contributions in chemical and nonlinear dynamics

Ramesh Chander, University of Roorkee, Roorkee, for his studies in seismology

A J Rao, Indian Institute of Science, Bangalore, for his work in endocrine biochemistry

K V S Rao, International Centre for Genetic Engineering and Biotechnology, New Delhi, for his contributions in immunology

Arup K Raychaudhuri, Indian Institute of Science, Bangalore, for his studies in low temperature physics

P Rodriguez, Indira Gandhi Centre for Atomic Research, Kalpakkam, for his work in mechanical metallurgy

A P Roy, Bhabha Atomic Research Centre, Bombay, for his studies in spectroscopy and light scattering

S K Saidapur, Karnataka University, Dharwad, for his contributions in reproductive biology

D D Sarma, Indian Institute of Science, Bangalore, for his work in solid state chemistry

Sarva Jit Singh, Maharshi Dayanand University, Rohtak, for his studies in theoretical seismology

H S Savithri, Indian Institute of Science, Bangalore, for her contributions in plant virology

R K Saxena, Jawaharlal Nehru University, New Delhi, for his work in immunology

M S Shaila, Indian Institute of Science, Bangalore, for her studies in molecular virology

R K Shyamasundar, Tata Institute of Fundamental Research, Bombay, for his contributions to theoretical computer science

C R Subrahmanya, National Centre for Radio Astrophysics, Pune, for his studies in radio astronomy
Haldane Centenary Symposium

A brief report on the symposium held during the 58th Annual Meeting on 6 November 1992 at PRL, Ahmedabad.

As a well-known American geneticist has written, for a man who, along with two others, laid the very foundations of a subject like theoretical population genetics, J B S Haldane was an amazingly versatile scientist. He made contributions in and wrote about physiology, enzyme kinetics, theoretical statistics, the origin of life, and many other topics. He also wrote about anthropology, philosophy of science, history of religions, and Indian culture. The last one of course represents part of Haldane's interest in and love of India.

H Sharat Chandra, Indian Institute of Science, Bangalore, who inaugurated the symposium to commemorate the birth centenary year - J B S was born on 5 November 1892 - of Haldane, recalled some of Haldane's work in his last seven years, which he spent in India. Haldane was born in Oxford, and is credited with being one of the three founders - the other two are the Britisher Ronald Fisher and the American Sewall Wright - of theoretical population genetics. He moved to India in 1957, and remained in this country till his death in 1964.

Haldane was a remarkable man, known, and perhaps feared, for his abrasiveness and provocativeness. He often took intellectually daring positions on scientific and other matters. Some of his provocative writings appeared in the Journal of Genetics, the oldest genetics journal in the English language, of which he was editor for many years. He brought the journal with him to India. The Indian Academy of Sciences, which held the centenary symposium as part of its 58th Annual Meeting, in Ahmedabad, now publishes the journal.

J H Edwards, a human geneticist at the University of Oxford, described some of Haldane's work. Sahotra Sarkar, of the University of Boston, traced the historical development of theoretical population genetics, in particular the contributions of Haldane, highlighting the wide variety of evolutionary scenarios explored by him.

One of Haldane's major interests was human genetics. Beginning with a description of the 'normal genetics' of complex disorders in man as outlined by Haldane, Partha Majumder of the Indian Statistical Institute in Calcutta explained his investigations towards elucidating the genetic basis of some deafness disorders found in India. N V Joshi of the Indian Institute of Science illustrated an extension of Haldane's family-level selection model to the competition between seeds within a fruit.

Near-Earth Environment

A brief report on the symposium held during the 58th Annual Meeting on 7 November 1992 at PRL, Ahmedabad.

All processes on the surface of the earth, physical, chemical as well as biological, are controlled directly or indirectly by the energy input from the Sun. The electromagnetic and charged particle radiations from the Sun travel through the interplanetary medium and reach the near-earth environment, where they encounter the earth's magnetic field. This interaction gives rise to the peculiar features in the magnetosphere. As they traverse further, interaction with the gases in the earth's atmosphere gives rise to electrons and ions which constitute the so-called ionosphere. Electric and magnetic fields together with neutral atmospheric winds dominate the processes in this region. At lower heights, in the so-called middle atmosphere, there are several important phenomena that are of immediate consequence to the earth's surface, climate and biospheric conditions. The importance of the ozone layer and the recent developments regarding ozone depletion, specifically the "Antarctic Ozone Hole" are well-known. Another recent development relates to the Greenhouse Effect and the Global Warming phenomenon.

In recent years, there have been major advances in our knowledge of this subject. In situ probes on rockets and satellites have given a radically new picture of the magnetospheric structure, the electric fields and plasma instabilities therein as well as the control of magnetospheric phenomena on ionospheric behaviour. Another development of recent years is in the area of ionospheric-thermospheric interaction. The ionised species constitute roughly one millionth of the background atmospheric medium. But they play a significant role in determining the structure and the
dynamics of the atmosphere. Further, charged particle penetration in the polar region can somehow have an impact on the behaviour of the equatorial ionosphere even though these particles cannot directly come to these regions. The causative mechanisms for the high latitude-low latitude interactions are yet to be theoretically understood. In the middle atmosphere the different aspects – chemistry and radiation budget, energetics and dynamics are all interconnected. Also changes taking place in the middle atmosphere have an impact not only on weather processes below, but also on phenomena at the upper atmospheric and ionospheric levels.

A C Das, PRL, Ahmedabad was the first speaker on “Solar wind magnetosphere interaction”. T Chandrasekhar, PRL, Ahmedabad next spoke on “Comets as probes of the interplanetary medium”. The third talk was by V V Somayajulu of the Vikram Sarabhai Space Centre, Trivandrum on “High latitude-low latitude ionosphere coupling”. He was followed by Y C Saxena of the Institute for Plasma Research, Gandhinagar on “Laboratory simulation of ionosphere irregularities”. The last three talks were by G S Lakhina, Indian Institute of Geomagnetism, Bombay on “Electrodynamic coupling between different regions of the atmosphere”, by R Sridharan, PRL, Ahmedabad on “Ionosphere-thermosphere coupling” and by A Jayaraman, PRL, Ahmedabad on “Middle atmosphere coupling processes”. After a brief discussion and concluding remarks by the Chairman the symposium came to a close.

Gujarat through the Ages

Summary of the evening lecture given by Dr S R Rao, National Institute of Oceanography, Goa on 7 November 1992 at the 58th Annual Meeting of the Academy held at Ahmedabad.

The first real evidence of civilization in Gujarat comes from the Harappan sites of Lothal, Dholavira, Surkotada and a few others, where sophisticated urban life around 2500 B.C. in all its complexities, can be seen. How this urban life developed from its rural beginnings is not yet clear, although pre-Harappan settlements are noticeable in varying degrees of cultural attainments. For instance, writing, as well developed as in mature Harappan days by 2500 B.C. is not to be found in the pre-Harappan days at those sites. Still earlier, the stone age man lived as a food gatherer and led a nomadic life.

Among the major enduring contributions of the Harappan civilization in Gujarat to science, technology, arts and man’s spiritual development are town-planning, marine engineering, mining and metallurgy, metrology and chemistry, besides the science of yoga and the invention of an alphabetic system of writing. The Harappans, as the architects of the Indus civilization are known to have built at Lothal a port town with maximum civic amenities. They took antiflood measures such as erecting platforms and peripheral walls to prevent damage by the overflowing river. The city was kept meticulously clean through a network of underground and surface drains and the urban discipline was so great that neither encroachments on streets nor choking of sewerages was permitted. The Harappans put to practical use their knowledge of tides, waves and currents by building a tidal dock for sluicing ships at flowtide and providing a safe berth. The copper ingots found in Lothal were the purest, and in demand in west Asia. The technical knowledge of Harappans was put to a peaceful purpose as attested to by the bronze tools such as the twisted drill and the circular saw. They had developed chemical processes of etching beads with an alkali, after heating them in a two-chambered kiln.

For large scale production, they standardized the form and composition of
goods and regulated trade by insisting on the certification of the source and the contents of cargo meant for export. The sealings found in the warehouse confirm the use of the famous Indus seals for commercial purposes.

The most important contribution of the Lothal scribes is the simplification of the writing into an alphabetic script which greatly facilitated recording the quick communication of thought. This cursive script later became the basis of the Semitic and Brahmi scripts.

The decimal graduation of weights and the ivory scale of Lothal is the minutest known in the Bronze Age. The unit in the weight system of Lothal corresponds to the Greek uncia and the British ounce, while ten divisions of the Lothal scale are equal to the angula of the Arthasastra. The experience gained by the Lothal hydraulic engineers enabled them to dispose of the liquid waste from the town by a self-cleaning system and also to introduce the lock-gate system in the dock, which could regulate the flow of water in ebb and flow tides.

The brick altars of Lothal and Kalibangan (Rajasthan) built for fire worship and animal sacrifice throw light on their religion, which was similar to that of the Vedic people. The language of the Indus seals is also not different from that of the Rigveda. There were other religious groups which venerated animals, but in course of time they were integrated in the fire cult. The Harappans had to leave their towns and cities which were destroyed by floods, for safer places in the east and south. Leaderless and less prosperous than before, the Late Harappans lived in scattered villages but did not give up their precious heritage, namely writing, religion and yoga, all of which survived in the Vedic period. Still later in 1500 B.C., the second urbanization is attested to by the archaeological evidence at Dwaraka which, however, lies submerged in the sea and has been recently discovered.

Special Issues of Journals


Although optical communication was demonstrated by Alexander Graham Bell way back in 1880, this area did not find favour for practical use due to the non-availability of a man-made source of monochromatic coherent radiation. The invention of the laser in the early 1960’s, the development of semiconductor lasers and the great advances in microelectronics since then, have heralded optoelectronics as a key interface area between optics and electronics and rekindling interest in optical communication. Light-wave communication has already become the backbone of modern communication, with the penetration of digital techniques in communication, the availability of low-loss optical fibres, high reliability semiconductor lasers, photodetectors and most of the electronic functions in LSI/VLSI form.

Optoelectronics is also important in several other areas such as information generation, processing and storage, computing and instrumentation. Not only are novel phenomena, new materials and fabrication technologies being investigated and new devices/IC’s being developed but optoelectronic systems are also being continuously updated.

In view of this, an International Conference on “Emerging Optoelectronic Technologies” was organized at the Indian Institute of Science, Bangalore during 16–20 December 1991, under the sponsorship of the International Society for Optical Engineering (USA) and the Jawaharlal Nehru Centre for Advanced Scientific Research (India). Over 150 papers were presented on all major aspects of optoelectronics in the 27 sessions at the conference, which also had 5 tutorial classes in this area to back up the programme. A small selection of 10 invited papers has been organized in this special issue, to provide the reader with a flavour of the emerging optoelectronic technologies in India and abroad.
Participants at the 58th Annual Meeting held at Ahmeda...
53. Prem Narain
54. P V Kulkarni
55. T Ramakrishnan
56. U W Kenkare
57. P K Gupta
58. V C Thakur
59. P G Adyalkar
60. H O Agrawal
61. I A Niazi
62. K R Rao
63. N K Notani
64. Asis Datta
65. N Panchapakesan
66. Sushil Kumar
67. C L Mehta
68. N Bhandari
69. S S Krishnamurthy
70. J P Mittal
71. M Vijayan
72. Surjit Singh
73. D V S Jain
74. K S Yajnik
75. S R Shenoy
76. C Dasgupta
77. S V Subramanyam
78. Harjit Singh
79. S N Tandon
80. D R Sikka
81. S Banerjee
82. B M Deb
83. M K Mehta
84. P S Goel
85. A M Kayastha
86. K K Kannan
87. P Natarajan
88. K Gopalakrishnan
89. M S Vardya
90. N S Narasimhan
91. K Kasturi Rangan
92. George Joseph
93. P C Agarwal
94. S C Dutta Roy
95. T K Roy
96. R Kumar
97. B Sethumani
98. M Rathnam
99. Peter Jayaraj
100. Partha P Majumder
101. Sahota Sarkar
102. D D Pant
103. B L K Somayajulu
104. N A Prakash
105. P K Das
Research activities concerning the interaction of light with matter have attracted scientists from diverse disciplines covering physics, chemistry, biology and technology. A seminar on “Photochemistry, Laser Chemistry and Photobiology — Fundamentals and Applications” was jointly organized at Madras during 7-9 January 1991, by the Indian Photobiology Society, the University of Madras and the Council of Scientific and Industrial Research. The present volume represents the proceedings of the conference and includes the 14 lectures and abstracts of the 54 posters presented at the seminar.

A one-day seminar on Ceramics and Glasses for Electronic Applications was held at the Central Glass and Ceramic Research Institute (CGCRI), Calcutta on 9 March 1991, organized by the Ceramics and Glasses Group of the Materials Research Society of India (MRSI), the Calcutta chapter of MRSI and CGCRI. The seminar consisted of nine invited talks and fifteen papers presented in a poster session. This special issue contains most of the invited lectures and a few of the poster papers and deals with ceramic superconductors, ferroelectric materials, optical fibres, magnetic ceramics, sol-gel processing of ceramics and glasses, non-composites involving glasses, laser glasses and ceramic sensors. The Editors hope that it will give some idea to the readers of the current R&D efforts in India in this rapidly expanding field of materials science.

A symposium on Rapid Solidification Processing was held at the Annual General Meeting of the Materials Research Society of India held at Bangalore from 9 to 11 February 1992. This special issue contains the four papers presented at the symposium with the text of the lecture by T R Anantharaman, the Distinguished Materials Scientist of the year on “Metallic structures: A magnificent obsession”. In addition this issue features a paper on rapidly solidified amorphous alloys by scientists from Belgrade.

Obituaries

Sadhan Basu was born on January 2, 1922 at Calcutta. He had his early schooling in Calcutta and graduated in 1942 from the Calcutta University.

He obtained his M.Sc. degree from the Calcutta University in 1945 and working on various properties of shellac at the Indian Lac Research Institute, Ranchi, obtained the D.Sc. degree from the Calcutta University in 1948. He joined the physical chemistry faculty of the Indian Association for the Cultivation of Science in 1948 and made significant contributions in polymer chemistry and the properties of polyelectrolytes. His work on chain transfer in radical polymerization is well-known. The method he developed for end group titration of nylon using phenol as solvent later became the standard procedure for the estimation of the molecular weight of polymers. His work on the effect of added electrolytes on coiling and the viscosity of nucleic acid solutions and other polyelectrolytes is equally well-known.

During his stay from 1951 to 1953 at the Indiana University as a Fulbright Fellow, he noted the emergence of quantum chemistry. On his return home, he published six papers on free electron MO calculations on several chemically interesting systems e.g. polyenes, pthalocyanine etc., and on important issues like nitrogen electronegativity correction and orientation of aromatic substitution.

In 1954 he joined as Reader in the Chemistry Department of Calcutta University. His work in polymer and polyelectrolyte extended to areas such as chemical control of the mechanical expansion of polyelectrolytes, metachromacy of dyes bound to several substrates etc. He calculated the paralocalization energy and correlated this to polarographic half-wave potentials. Recognizing the implications of Mulliken’s work on charge transfer (CT) interactions, he studied many aspects of it, the most notable observation being the CT vibrational structure. He also noticed that organic solvents quench the fluorescence of aromatic molecules by excited state contact CT interaction. He next worked on H-bonding for studying interactions in biological systems and on absorption spectroscopy of metal complexes and using polarized spectroscopy, determined the trigonal crystal field splittings. In late sixties he once again turned his attention to the spectroscopy of inorganic complexes in unusual oxidation state, interesting
coordination and intervalence transitions. His varied interests also touched many other topics like F-centres in phosphate glass, magnetic perturbation of triplet transitions etc.

Later he made an extensive application of free electron MO theory to calculate various molecular properties like magnetic susceptibility, Cotton-Mouton constant of optical rotation, polarizability and hyperpolarizability, sublimation energy of benzene and so on. His review on solvent effects in spectroscopy, now a classic, correctly predicted the tremendous growth in this field in later years.

His widespread interests ranged from polymer chemistry, properties of polyelectrolytes and biopolymers in solution on the one hand to quantum chemistry, electronic spectroscopy and NQR on the other. One of the leaders in popularizing teaching and research in quantum chemistry he was one of the founding editors of International Journal of Quantum Chemistry. His basic strength lay in his very strong chemical intuition and the uncanny ability to identify an area at a very early stage. Since he always ventured into unexplored areas, whatever he did was unmistakably novel. Throughout his life he maintained his habit of doing research with his own hands. He had a strong dislike for publicity and kept himself away from all the power centres.

He became the Palit Professor of Chemistry of Calcutta University in 1964 from which position he retired in 1985. He was the Head of this department from 1978 to 1980 and Director, Indian Association for the Cultivation of Science from 1980 to 1981. He was elected a Fellow of the Academy in 1974. He won the Shanti Swarup Bhatnagar Prize in Chemistry in 1965 and was elected a Fellow of the Royal Institution of Chemistry in 1957.

He passed away at Calcutta on 5 October 1992, leaving his wife, daughter and son and several generations of physical chemists, whom he had taught and inspired through his research and teaching, to mourn his loss.

Anekal Ramaswamiengar Gopal-Ayengar was born on January 1, 1909 in the village Anekal in the former Mysore State. He had his early education in Mysore and obtained his Bachelor of Science degree in 1929 and Master of Science degree in 1933 from the Mysore University. From 1933 to 1938 he served as lecturer in cytology at the Mysore University. He was awarded the prestigious Vincent Massey Fellowship at the University of Toronto in 1938 where he obtained M.A. and Ph.D. degrees. Dr Gopal-Ayengar was then employed as Senior Instructor and Research Associate at the University of Toronto from 1941 to 1945. During 1945 to 1947, he worked as Kettering Research Fellow at the Barnard Skin and Cancer Hospital of Washington University, St. Louis, Missouri.

He returned to India in 1947 and was appointed Chief Research Cytologist at the Tata Memorial Hospital. He was one of the first scientists appointed by the Atomic Energy Commission in 1948 and was posted as Head of the AEC Unit on Cell Biology. He laid the foundation of modern multidisciplinary biomedical research under the Department of Atomic Energy. This he accomplished in various capacities starting from Assistant Director, Biology Division in 1953 to Director, Bio-Medical Group, the position from which he retired on superannuation in 1969. He served as Adviser to the Department of Atomic Energy from 1971 to 1976 and as Guest Professor of Biophysics, Institute of Biophysics, University of Hannover (1976 to 1982).

He had wide interests in several areas of modern biology. Though the structure, function and behaviour of chromosomes was his first love, he made outstanding contributions in the basic and applied aspects of radiobiology, radiation biophysics, cytochemistry, mutation research, cancer research, risk perception and evaluation, and human health. He was one of the pioneers in isolating DNA from mouse chromosomes, his paper being published in Cancer Research in 1947. He made outstanding contributions on molecular organization and the fine structure of chromosomes, and the cytological and cytochemical effects of radiations and radiomimetic substances on proliferating cells. He pioneered investigations on radioactivity, chromosomal aberrations and genetic effects on plants growing in high background radiation areas of the Kerala Coast. With the commissioning of the Apsara reactor, he extensively investigated the biological effects of neutrons and the use of neutron irradiation in agriculture and in applied genetics. He visualized the mutagenic potential of neutrons in enhancing the genetic variability in crop plants and its use in developing more productive varieties of crop plants. He pioneered at studies on radiation sensitization of cells and enhancement of radiation lethality by such chemicals which are now finding applications in radiation therapy.
He was elected a Fellow of the Academy in 1965. He served as President, Commission on Radiation Biophysics of International Union on Pure and Applied Biophysics (IUPAB), and as Chairman, United Nations Scientific Committee on the Effects of Atomic Radiation. He was a member of the International Society for Cell Biology, the American Society of Cancer Research, the New York Academy of Sciences, the American Association for Cancer Research, the American Society for Cell Biology and the Genetical Society of Great Britain. In recognition of his outstanding contribution to science, teaching and human health, he was awarded the Honorary Degree of the Doctor of Science from the University of Hannover in Germany and from the University of Mysore. He was the recipient of Padma Shri in 1967.

We owe a great deal to his vision for laying the strong foundation of research in the areas of molecular biology, radiation biology, biochemistry, biotechnology and nuclear applications in agriculture, food technology and medicine in the institutions supported by the Department of Atomic Energy.

Gopal – as he was known – was greatly admired for his eloquence and wit. He always had a good reservoir of stories for all occasions. He had a keen commitment towards the application of science and technology for the welfare of mankind. He was deeply concerned with the slow pace of progress in the country. It is sad that one who devoted a great deal of his early career in investigating the behaviour of cancerous cells, had to bear the pain and agony of the disease in the last days of his life.

He passed away on 8 September 1992 at Bombay leaving a large circle of friends and admirers to mourn his loss.

Viswanath Narayan Likhite was born in 1896 in the then Bombay Presidency. He had his early education in Nasik, Jalgaon and Dhuilia High Schools and his university education in Deccan and Fergusson Colleges, Pune. He obtained his B.A. degree in 1918 and B.Sc. degree in 1920. He worked as Lecturer in Biology in the Indian Women’s University and in the Fergusson College from 1919 to 1922. He left India for higher studies and obtained the State Doctorate of France from the Strasbourg University in 1926. He worked as Assistant to the Plant Pathologist, Cornell University during 1926–27 and in the Institute of Mycology, Wageningen, Holland from 1927 to 1929. On his return to India, he joined the Baroda State Service in the development of agriculture and served first as Deputy Director and later as Director of Agriculture, in Baroda.

He left India again in 1950 to work as a Professor of Botany first in McPherson College, Kansas and then in Elgin State Hospital as a histochemist. Later he taught in the Bishop College and Wiley College in Marshall, Texas.

On retirement he settled in Evanston, Illinois with his son. Though he passed away on 1 April 1980 at Evanston, the Academy received this information only recently.

Herman Francis Mark was born in Vienna, Austria on 3 May 1895. After his high school years spent in Vienna, he served in the Imperial Austrian Army from 1913–18 during the First World War, being wounded twice and spending 8 months as a prisoner of War in Italy. On his return he resumed his study of Physics and Chemistry at the University of Vienna, obtained his Ph.D. in 1921 and joined as instructor in the first chemical laboratory of the University of Berlin, the undisputed leader in organic chemistry at the time. A year later he joined the new Kaiser Wilhelm Institut für Faserstoff-Chemie in Berlin Dahlem, where he worked first as Research Fellow and later as Group Leader till 1926. In 1927 he joined the I.G. Farben-Industrie in Ludwingshafen on Rhine as Research Chemist, became group leader in 1928 and Assistant Research Director in 1930. At the same time he was Associate Professor of Physical Chemistry at the Technical University in Karlsruhe.

In 1932, he was appointed Professor of Chemistry and Director of the First Chemical Institute at the University of Vienna, Austria, where he stayed until 1938 continuing his research and also teaching in the then new field of polymers. After the Nazi invasion of Austria in 1938 he was dismissed and left Europe to become Research Manager of the Canadian International Paper Company in Hawkesbury, Ontario, Canada. Realizing that his work in Hawkesbury would remain essentially restricted to cellulose without contact with the rapidly developing field of synthetic polymers, he left Hawkesbury in 1940 and joined at half his salary as Adjunct Professor of Organic Chemistry at the Polytechnic Institute of Brooklyn. He was promoted to full Professor in 1942 and
appointed Director of the Polymer Research Institute in 1946, working in the area of synthetic fibres, films and rubbers. He was made Dean of the Faculty in 1961.

In 1964 he resigned as Director of the Polymer Research Institute and in 1965 as Dean of the Faculty. He served as Dean Emeritus at the Brooklyn Polytechnic University and an Emeritus Member of the Corporation of the Brooklyn Polytechnic till his death.

A world-renowned authority in polymer chemistry, his main research was on X-rays and electrons for the study of structure of matter, on the synthesis, characterization, reactions and properties of natural and synthetic polymers, such as cellulose, silk, wool, rubber, proteins, starch and all types of synthetic products. He wrote over 20 books on various topics related to polymer chemistry and published nearly 600 papers during six decades of active research.

He was a member or fellow of over 45 societies including the Royal Institute of Great Britain and the National Academy of Sciences of USA. He was elected a Fellow of the Academy in 1949 and received numerous awards and medals from different countries, including the Legion d'Honneur from France and the Gold Medal from the Indian Association for the Cultivation of Science in 1962.

He was instrumental in the publication of a series of volumes on “High Polymers”, 18 monographs on monomers and polymers, 16 volumes of “Polymer Reviews”, and the 16-volume “Encyclopaedia of Polymer Science and Technology”, the founding of the Journal of Polymer Science and organization of the Institute of Polymer Research at the Brooklyn Polytechnic. Polymer Science which had started to develop into a specific branch of organic chemistry in the 1920’s had by the 1960’s became a well-established science in its own right.

After his retirement in 1961 he devoted his time to the development of literature on polymer science and engineering and to the principles of teaching the new science at different levels and with different special purposes. His association with India involved the installation of a polyester-polyamide pilot plant at the Sasmira Organization in Bombay. The spinning and weaving plant was officially opened in April 1982 during an International Symposium on “Man-made Fibres” at Bombay.

He passed away in New York in April 1992.

Mandagere Bharadwaj Ramachandra Rao was born in August 1906 in a not too affluent family, he had to struggle through his early education. The frequent transfers of his father did not help matters but they did have the positive result of inculcating in the young mind an undying love for the diverse terrains and peoples of Karnataka. Against several odds he obtained his B.Sc. in 1926 from Mysore University and through a fortunate combination of circumstances, secured a footing in the Mysore Geological Department (MGD) as Assistant Geologist in 1928.

There followed a period of intensive training in geological, mineral prospecting and soil surveys, during which he studied for and obtained his M.Sc. degree from Mysore University in 1933. The turning point in his career came in 1937 when he was introduced to geo-electrical methods of surveying under A.B. Droughton Edge. It brought him into direct contact with the world of geophysics which was making its debut on the Indian scene. So profound was his comprehension of this world that three years later he was appointed Gologist and Geophysicist of the MGD. Independently he carried out geological and geophysical exploration for sulphide ores, graphite, ground water etc., as also engineering investigations for dams, tunnels, hydroelectric projects etc.

It was his good fortune that his formative years in MGD were under some of the finest geologists of the country: Sampat Iyengar, N. Jayaraman, B. Rama Rao to name a few. The disciplined and professional integrity of these stalwarts deeply influenced his career.

In 1944 his services were lent to the then Madras Presidency for the geophysical investigations of the area in which the Ramapadsagar dam was to cross the Godavari river. In 1947–48 he was deputed to USA, Canada and UK for higher technical training in geophysics.

More direct recognition came in 1949 when the Government of India appointed him as the Chief Geologist in the Geological Survey of India (GSI) at Calcutta. Systematic geophysical exploration for manganese, copper, sulphide ores etc., was initiated in the areas as widely separated as Singhbhum, Khetri and Chitradurg. More importantly, exploration for oil in the Cambay and Cauvery basins was undertaken.
He was transferred from GSI to ONGC and appointed as Director of Geophysics. Across the subcontinent, a vast programme of magnetic, gravity and seismic surveys was initiated in the sedimentary basins of hydrocarbon interest. One such area was the Cambay basin where his insistence on drilling, despite much scepticism and debate, led to the discovery of the Cambay Field in 1959. It was also in 1959 that the ONGC became a statutory body and he was appointed Member (Technical and Administration) of the Commission. He was briefly on the Board of Oil India Limited, a joint venture enterprise between the Government of India and the Burmah Oil Co. Ltd. He retired in 1962 but continued as consultant to the ONGC till ill-health forced him to leave Dehra Dun in 1964.

He worked on various aspects of geophysics and wrote 'Outlines of geophysical prospecting' published by the University of Mysore in 1975. He kept close links with the academic world through lectures and visits to centres of learning in Calcutta, Waltair, Varanasi and Dhanbad. He was the President, Association of Exploration Geophysicists and Vice-President, Geological Society of India. He was elected a Fellow of the Academy in 1957. In 1972, he was awarded the Padmabhushan in recognition of his outstanding services to the nation.

A man of utmost simplicity, courtesy and helpfulness, he was a deeply religious man and it was doubtless this faith that enabled him to retain his equanimity and mental alertness despite increasing difficulties of hearing and vision, immobility and much physical pain during the last four years of his life.

He passed away at Bangalore on 4 September 1992.