



Patilika

January 1995 No. 33 Newsletter of the Indian Academy of Sciences

Diamond Jubilee Meeting

It was in April 1934 that the Academy was formally registered in Bangalore but the formal inauguration took place on 1 July 1934 at a public meeting at the Indian Institute of Science. It was therefore appropriate that the sixtieth annual meeting of the Academy was also held at the Indian Institute of Science. The meeting was held from 30 November to 2 December 1994 and was attended by over 250 Fellows and Associates. The inaugural session on the morning of Wednesday 30 November 1994 at J.N. Tata Auditorium of the IISc was attended by over 700 participants. Welcoming the gathering, Prof. G. Padmanaban, the Director of the Institute, who also happens to be one of the Academy's four Vice-Presidents, traced the connection between the Academy and the Institute and drew attention to the unique opportunity that this meeting offered to research staff in IISc of listening to lectures by a diverse cross-section of scientists and scientific disciplines. The President of the Academy, Prof. R. Narasimha, then introduced to the audience the Fellows and Associates who were present.

Prof. Narasimha then delivered his presidential address on "Turbulence: Waves or events?" Turbulent flows, whether in technology or nature, are generally characterized by shear in the mean velocity; indeed the mean flow is often driven by turbulent fluxes of momentum, energy, etc. To describe the time series of such fluxes, the stochastic tools in current use, such as generalized harmonic analysis and (more recently) wavelets, are inadequate, as they do not provide an assessment of contributions to the mean (rather than the mean square) of a sign-indefinite quantity like the flux. Recent analysis of momentum flux in the atmospheric surface

layer has shown, however, that an episodic description is both feasible and more natural for the flux process, which to a first approximation can be described as a 'chronicle' of signed two-parameter events. In this view flux is generated in short intense bursts; a parameter called burstiness, which is a measure of temporal compactness in contributions to the mean (and varies from zero when flux generation is evenly distributed in time to unity when the chronicle is a sequence of delta functions), has a value of 70–80% in a neutral atmospheric surface layer. It is also found that the motions are productive (for flux generation) about 35% of the time, counter-productive for about 15% of the time, and essentially idle (with weak motions cancelling each other) at other times. In conclusion, Narasimha suggested a tentative answer to the question in the title of his address, viz. that turbulence can be both waves and events – but the waves are passive, and all the flux comes from the events, which to a first approximation are always members of a signed two-parameter family, with the positive events outnumbering and outlasting the negative ones in a neutrally stable flow.

The morning session on 30 November also had lecture presentations by four new Fellows/Associates of the Academy. These were by J. Maharana (Institute of Physics, Bhubaneswar) on "Physics at the Planck scale", B.K. Godwal (Bhabha Atomic Research Centre, Bombay) on "Condensed matter at ultrahigh pressures", Nimish A. Shah (Tata Institute of Fundamental Research, Bombay) on "Unipotent flows and counting integral points on rational homogeneous varieties" and P.P. Das (Indian Institute of Technology, Kharagpur) on "Fractal image compression". This session was chaired by Prof. S. Ramaseshan.

The afternoon session on 30 November was devoted to a symposium on "Aspects of complexity and complex systems". Prof. N. Kumar chaired the session and introduced the

topic. The symposium had four lectures: by Deepak Dhar (Tata Institute of Fundamental Research, Bombay) on "Self-organized criticality in sandpile models", by Debashish Chowdhury (Indian Institute of Technology, Kanpur) entitled "Immune network: an example of complex systems", by M. Vidyasagar (Centre for Artificial Intelligence and Robotics, Bangalore) entitled "Neural networks and generalization" and by Sanjay Jain (Indian Institute of Science, Bangalore) on "Complexity in evolutionary models".

The first day's session concluded with the customary annual business meeting of Fellows at the Institute's Faculty Hall in the evening. Besides the statutory items of approving the annual report and the accounts for the financial year 1993–94, there was a discussion on the draft document prepared by a panel constituted by the President of the Academy to examine the question of "University Education in Science" and informal off-the-cuff presentations by a few Fellows on such topics as the recent controversy regarding the outbreak of what was referred to as plague (G. Padmanaban), some interesting facets of chemistry and bonding, theory and analysis (J. Chandrasekhar), underground water resources (P.G. Adyalkar), and the dimer component in water vapour (P.R. Pisharoty).

The second day, Thursday 1 December, started with a special lecture by T. Kailath of Stanford University on "The legacy of Norbert Wiener". A summary of the talk appears elsewhere in this issue. This lecture was followed by a symposium entitled "Frontiers in engineering science". The speakers were A.P.J. Abdul Kalam (Scientific Adviser, Ministry of Defence, New Delhi) on "Technology and India's future", R.A. Mashelkar (National Chemical Laboratory, Pune) on "Borderless chemical engineering science: The new challenge", B.L. Deekshatulu (National Remote Sensing Agency, Hyderabad) on "Remote sensing: A frontier tool for national development" and S.M. Deshpande (Indian Institute of Science, Bangalore) on "Computational fluid dynamics: Current status and future directions".

The afternoon session held at the Faculty Hall of the Institute consisted of seven lecture presentations by new Fellows/Associates. The first three lectures, presided over by Dr S. Varadarajan, were by A. Srikrishna (Indian Institute of Science, Bangalore) on "Chiral synthons via radical cyclization reactions", Uday S. Agarwal (Indian Institute of Technology, New Delhi) on "Design of fracture-resistant polymers: in solution under elongational flow" and by M. Periasamy (University of Hyderabad,

Hyderabad) on "New routes for the synthesis of organometallic reagents". The other four lectures, presided over by Prof. H. Sharat Chandra, were by Kamala Krishnaswamy (National Institute of Nutrition, Hyderabad) on "Diet, malnutrition and cancer: The Indian scenario", by Asha K. Kinger (All India Institute of Medical Sciences, New Delhi) on "Identification and cloning of genes differentially expressed in the virulent strain of *Mycobacterium tuberculosis*", by S.C. Lakhota (Banaras Hindu University, Varanasi) on "Regulation of a *Drosophila* heat shock gene without protein coding function", and by K. Muniyappa (Indian Institute of Science, Bangalore) on "Homologous genetic recombination: Insights from studies of bacterial proteins".

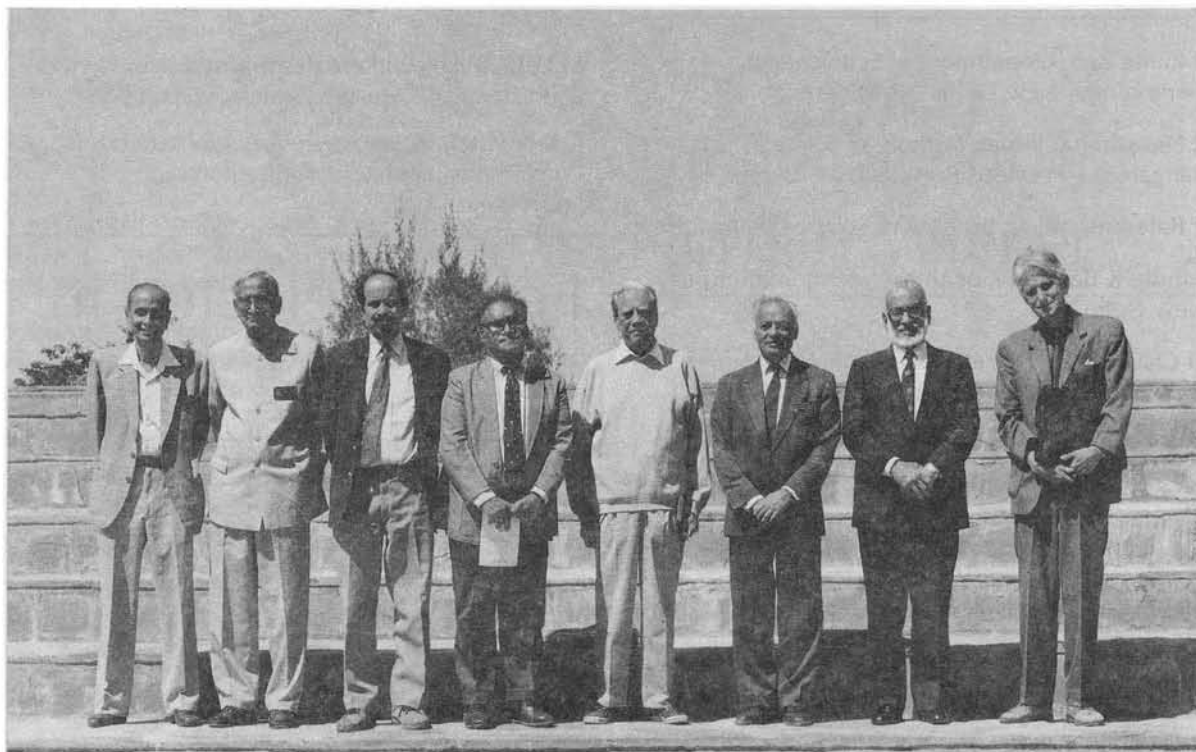
The final day's programme on the 2nd of December was designed to be more of a public function with a series of special lectures. The President of the Academy, Prof. R. Narasimha, in his opening remarks traced the history of the Academy and its current activities and considered the future directions of the Academy. This was considered in greater detail in the afternoon when there was a special discussion session on "Academy: Past, present and future". Seven past presidents who attended the meeting expressed their views on the directions that the Academy should take in the years to come. A few Fellows also spoke at the session. The discussion in this session was preceded by a slide show on Prof. C. V. Raman by Prof. G. Srinivasan. The special lectures delivered were by Prof. C.R. Rao (Pennsylvania State University, USA) on "The fascination of statistics", by Prof. Govind Swarup (National Centre for Radio Astrophysics, Pune) on "Radio astronomy and the structure of the universe", by Prof. A.K. Ramdas (Purdue University, USA) on "Diamonds: Science, fiction and lore" and by O. Siddiqi (Tata Institute of Fundamental Research, Bombay) on "Perception of chemicals". The evening lecture, which also was the concluding lecture of the meeting was by General K. Sundarji (former Chief of Army Staff) on "India 2015: A strategic perspective".

There were two cultural evenings, on the 30th November and 1st December, both at the J.N. Tata Auditorium. The first was a play in Kannada of Shakespeare's "A Midsummer Night's Dream" and was superbly performed by Rangayana. The second was a veena recital by Suma Sudhindra on the 2nd of December. The veena recital was followed by a banquet at Hotel Ashok.

The Diamond Jubilee meeting was organized at the IISc with the help of a large number of Fellows and others in Bangalore and the Academy staff. There were committees to look

after accommodation, transport, catering, registration, lecture hall arrangements, cultural programmes etc. The Academy is indebted to all those in Indian Institute of Science and elsewhere who helped in the successful organization of this meeting as also to a large number of government departments,

universities, institutions and industries who provided financial support to the Academy. The Academy is also grateful to all lecturers, especially those who gave the special lectures, and to N. Kumar, who organized the symposium on "Aspects of complexity and complex systems".



Past Presidents of the Academy who attended the Diamond Jubilee Meeting

Council for the triennium 1995–97

P Rama Rao, Department of Science and Technology, New Delhi – President

R Narasimha, Indian Institute of Science, Bangalore – Previous President

P Balaram, Indian Institute of Science, Bangalore

Sandip K Basu, National Institute of Immunology, New Delhi

D Chakravorty, Indian Association for the Cultivation of Science, Calcutta

M K Chandrashekar, Madurai Kamaraj University, Madurai

R Chidambaram, Atomic Energy Commission, Bombay – Vice President

S M Chitre, Tata Institute of Fundamental Research, Bombay

B M Deb, Panjab University, Chandigarh

R Gadagkar, Indian Institute of Science, Bangalore – Secretary

Sudha G Gangal, B J Wadia Hospital for Children and Institute of Child Health, Bombay

V K Gaur, C-MMACS, National Aerospace Laboratories, Bangalore – Editor of Publications

K Kasturirangan, Department of Space, Bangalore

V Krishnan, Indian Institute of Science, Bangalore

N Kumar, Raman Research Institute, Bangalore

R A Mashelkar, National Chemical Laboratory, Pune – Vice President

G Padmanaban, Indian Institute of Science, Bangalore – Vice President

K B Sinha, Indian Statistical Institute, New Delhi – Vice President

G Srinivasan, Raman Research Institute, Bangalore – Treasurer

N Viswanadham, Indian Institute of Science, Bangalore – Secretary

Honorary Fellows elected in 1994

Peter Day, Director and Resident Professor of Chemistry, Royal Institution of Great Britain, London, UK

M Oda, Rikagaku Kenkyusho Institute of Physical and Chemical Research, Saitama, Japan

C K N Patel, Vice Chancellor of Research Programmes, University of California, Los Angeles, USA

Fellows elected in 1994

G Ananthakrishna, Indian Institute of Science, Bangalore, for his contributions in the field of condensed matter and materials science

Anil Kumar, Indian Institute of Science, Bangalore, for his work on the physics of phase transitions

A R Chakravarty, Indian Institute of Science, Bangalore, for his work in organometallic chemistry

K Chattopadhyay, Indian Institute of Science, Bangalore, for his contributions to metallurgy

Bhaskar Datta, Indian Institute of Astrophysics, Bangalore, for his work in theoretical astrophysics

N K Ganguly, PG Institute of Medical Education and Research, Chandigarh, for his work in the field of gastroenterology

S E Hasnain, National Institute of Immunology, New Delhi, for his contributions to genetics

Javed Iqbal, Indian Institute of Technology, Kanpur, for his work on organic synthesis

P I John, Institute for Plasma Research, Gandhinagar, for his contributions in the field of experimental plasma physics

S Kailas, Bhabha Atomic Research Centre, Bombay, for his work in nuclear physics

C C Kartha, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum, for his contributions to cardiac pathology

A B Mandal, Central Leather Research Institute, Madras, for his work in the field of physical chemistry

Subhashis Nag, Institute of Mathematical Sciences, Madras, for his work in complex analysis

B C Nakra, Indian Institute of Technology, New Delhi, for his contributions to structural dynamics

S W A Naqvi, National Institute of Oceanography, Dona Paula, for his work in the field of chemical oceanography

S K Panda, All India Institute of Medical Sciences, New Delhi, for his studies on viral hepatitis

V S Patwardhan, National Chemical Laboratory, Pune, for his contributions to chemical engineering models

V Prakash, Central Food Technological Research Institute, Mysore, for his work in the field of protein chemistry

Dipendra Prasad, Mehta Research Institute, Allahabad, for his studies on group representations

H A Ranganath, University of Mysore, Mysore, for his contributions in the field of genetics

B C Ranu, Indian Association for the Cultivation of Science, Calcutta, for his work in organic synthesis

D S Ray, Indian Association for the Cultivation of Science, Calcutta, for his contributions to theoretical chemistry

Veronica F Rodrigues, Tata Institute of Fundamental Research, Bombay, for her work in the field of genetics

Abhijit Sen, Institute for Plasma Research, Gandhinagar, for his contributions in plasma theory

S Sivasanker, National Chemical Laboratory, Pune, for his studies on catalysis

Sri Niwas, University of Roorkee, Roorkee, for his contributions in the field of theoretical geophysics

R Sridharan, Physical Research Laboratory, Ahmedabad, for his work in atmospheric physics

N C Subramanyam, University of Hyderabad, Hyderabad, for his contributions to plant genetics

R Sunder, National Aerospace Laboratories, Bangalore, for his work on engineering fatigue

Ghanshyam Swarup, Centre for Cellular and Molecular Biology, Hyderabad, for his studies in protein biochemistry

P S Thiagarajan, SPIC Science Foundation, Madras, for his contributions to theoretical computer science

A K Tyagi, University of Delhi, Delhi, for his studies in the field of biochemistry

Shashi Wadhwa, All India Institute of Medical Sciences, New Delhi, for her work in neurobiology

The legacy of Norbert Wiener

Summary of the lecture delivered by Kailath, Stanford University, USA

Prof. T. Kailath of Stanford University spoke on the topic 'The legacy of Norbert Wiener', a title he clarified was too broad a canvas for a subject like Wiener and therefore changed to the more manageable 'The mathematical engineering legacy of Wiener'. The year 1994 marked the birth centenary of Wiener. A major symposium, lasting a full seven days, at MIT celebrated the occasion by touching on most things that Wiener contributed to and concerned himself with. Kailath's lecture was sprinkled with several humorous asides and anecdotes, including the fairytale about the giant in seven-league boots that he used to illustrate the importance of theory in engineering. The giant, confronted with the problem of getting to a place eleven miles away when his boots only allowed seven-league or 21-mile steps, could not figure out that two steps that described the two equal sides of an appropriate isosceles triangle would do the job. Kailath wanted to drive home the point that, even with supercomputers with which to attack a complex problem by, say, the simulation route, we need mathematical theory. He also illustrated the use of mathematical theory in the modern electronics industry by mentioning use of abstract mathematical ideas in the design of high-speed modems and use of control and signal processing theory in large-volume semiconductor chip assembly.

Wiener made pioneering contributions in mathematical engineering, a phrase that is not common and one that tends to reflect the distance that existed between the two well-known branches of electrical engineering, viz. the physics or solid state devices branch and the

systems and control theory or mathematics branch. With the explosion in digital communication and computer science, the attendant isolation from each other of the practitioners of these two branches no longer exists. In another humorous aside, Kailath illustrated the attitude of engineers of earlier years to theory by showing a cartoon depicting a 'theoretical plumber' called in to plug a leaking pipe; the plumber was shown considering such things as the effect of freezing the water on the leak!

Wiener, who got a Ph.D. from Harvard – he then went on a European tour and spent time with G.H. Hardy, Bertrand Russell and Max Born, and worked as a reporter for the *Boston Globe* – , went on to get a position at MIT, which was not a major mathematics centre then. But by 1930 Wiener was already famous as a mathematician. Wiener is one of only two persons honoured by the American Mathematical Society with a special issue of its journal devoted to each of them after their passing – the other is John von Neumann. Wiener's work is responsible for much of the revolution in digital communication today, and von Neumann is the father of the modern stored-program digital computer. Kailath emphasized the point that 'digital conversion' between computers and communications is what has brought in the information revolution and would light our way in the future.

One of Wiener's well-known beliefs was that 'concrete cases are good for the morale of a mathematician', a statement he made in an obituary of G.H. Hardy. While Hardy prided himself in the belief that none of what he did would have the slightest application, Wiener wrote that number theory, in which Hardy excelled, was a 'concrete case'. During World War II, Wiener made proposals to the US government on applications of mathematical tools to practical problems in aircraft design and flight dynamics. Wiener's work has had great impact on electrical engineering. Claude Shannon, the father of information theory, acknowledged the early contributions of Wiener. Kailath also made passing reference to Wiener's wide range of interests and knowledge, and mentioned the two volumes of his published autobiography and the book (recently published) *The Nature of Invention* based on a manuscript Wiener wrote in 1954. Kailath also mentioned the four volumes of the collected papers of Wiener edited by K.C. Nadkarni, who taught at Elphinstone College in Bombay and, later, worked with Wiener.

Human reproduction in the 21st century

Summary of an Academy Lecture given by R.G. Edwards, Churchill College, Cambridge, UK, on 25 November 1994 at Bangalore

Prof. R.G. Edwards' main contribution has been the development in collaboration with gynecologist Patrick Steptoe of the technique of *in vitro* fertilization and embryo transfer for the first time in the world. The advent of this technology was the harbinger for many other medically assisted reproductive technologies (MARTs) which have now given hope to many infertile couples who would have otherwise died in despair. The public lecture was a sensible blend of research in molecular developmental biology and the societal implications of the new reproductive technologies.

The first part of the lecture dwelled on the difficulties in achieving 100% pregnancy rates following *in vitro* fertilization. Statistically an 80% success rate can be achieved only after five attempts of IVF. The cost for each treatment cycle is so high that alternative methods of treatment must be sought. The induction of menstrual acyclicity by administering GnRH prior to ovarian stimulation can improve pregnancy rates from 12% to 20%.

Although male infertility due to poor sperm quality can be treated by IVF, these attempts are not always successful in leading to a pregnancy. Some of the newer attempts to improve fertilization rates are drilling of the outer membrane of the oocyte to facilitate the penetration of the spermatozoa into the egg, and directly injecting a single sperm into the cytoplasm of the egg. This technique has been so successful that cases are known where more number of eggs have been available through ovarian hyperstimulation and oocyte retrieval procedures than the number of sperms available for fertilization by aspirating them microscopically from the epididymis of a male with severe male infertility. Yet, by intracytoplasmic injection of a single sperm, the eggs have been fertilized, leading to pregnancy and live births.

It is now possible to prevent sex-linked inherited diseases by preselecting sperms of the desired sex and using them for insemination and pregnancy, by carrying out a single cell biopsy of the blastocyst and determining its genetic constituents by polymerase chain reaction and transferring only those embryos that are not genetically defective.

The advent of MARTs has also made it possible for older, menopausal women to conceive by oocyte embryo donation and hormonal supplementation because the uterus does not seem to age as do the ovaries which once depleted of the oocyte contents cannot be restored to have a new crop of eggs.

The technology of MARTs has developed to such a fine extent that it is now possible for a woman to give her eggs to the IVF laboratory on her way to work and have the embryo transferred into her when she returns from work.

Special Issues of Journals

The year 1994 was the Diamond Jubilee of the founding of the Academy. It was also the 60th year of the *Proceedings of the Indian Academy of Sciences*. As part of the Diamond Jubilee celebrations special theme issues on topics of current interest were brought out in Chemical Sciences (2) Mathematical Sciences (1) and Materials Science (1)

1. *Proceedings Chemical Sciences*, Vol. 106, Number 3, June 1994, pages 591–811. "Modern Trends in Inorganic Chemistry".

This issue includes the plenary talks presented at the meeting on Modern Trends in Inorganic Chemistry (MTIC-5) held recently in the Indian Institute of Science, Bangalore, to focus on the advances made in the area of inorganic chemistry. Substantial progress can be recognized in the areas of coordination chemistry, structure and reactivity, bioinorganic chemistry, organometallic chemistry, homo and heterogeneous catalysis, reaction kinetics, solid state inorganic chemistry and others. Novel syntheses, interesting structures and important bonding features reported here discuss unusual properties in inorganic compounds. The large

number of posters presented at the conference give an overview of the breadth of research and, in the area of inorganic chemistry, encompass novel material preparations, photoexcited state properties of coordination compounds, unusual structures of metal chelates, structure-reactivities of organoelemental compounds, metal clusters, general aspects of bioinorganic chemistry and others. The issue includes 18 papers and the abstracts of 55 posters presented at the symposium.

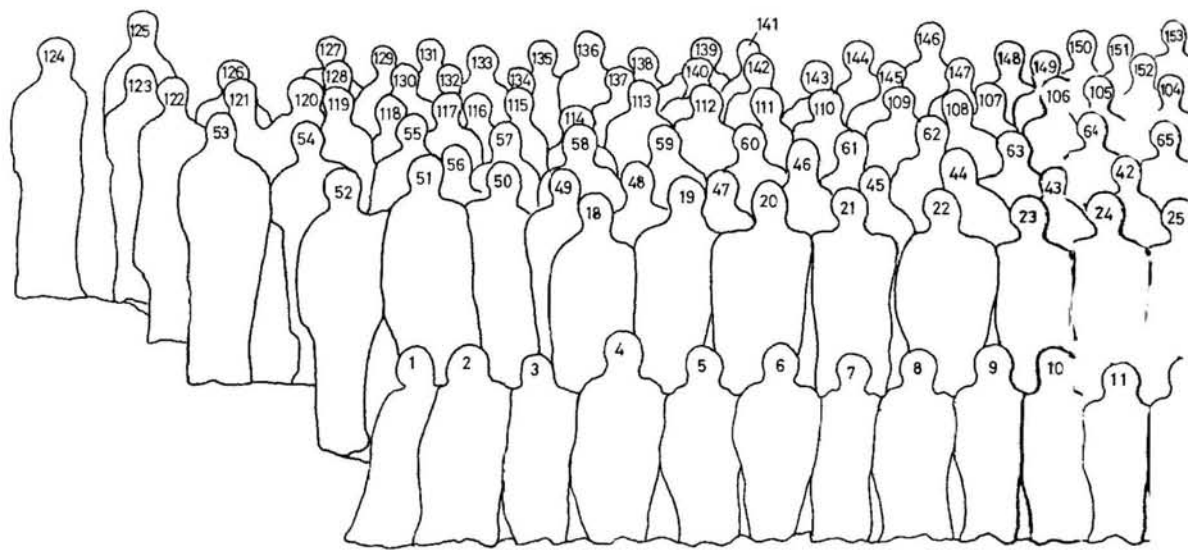
2. *Sadhana: Academy Proceedings in Engineering Sciences*, Vol. 19, Part 4, August 1994, pages 543–614. "Disaster Mitigation".

Natural hazards are a part of the dynamics of the outer working parts of the earth's thermodynamic engines; and their course in many cases cannot be stayed. But disasters caused by them can be significantly minimized by designing and enforcing hazard-resilient land use plans, building codes and other safety and avoidance measures. Current understanding of the space-time characteristics of natural hazards offers considerable insight in designing effective hazard reduction programmes as well as a research agenda that would progressively vitalize this endeavour. The issue includes six papers by acknowledged experts in the field on hazards from tropical cyclones to droughts and earthquakes, and disaster mitigation systems in vogue in India.

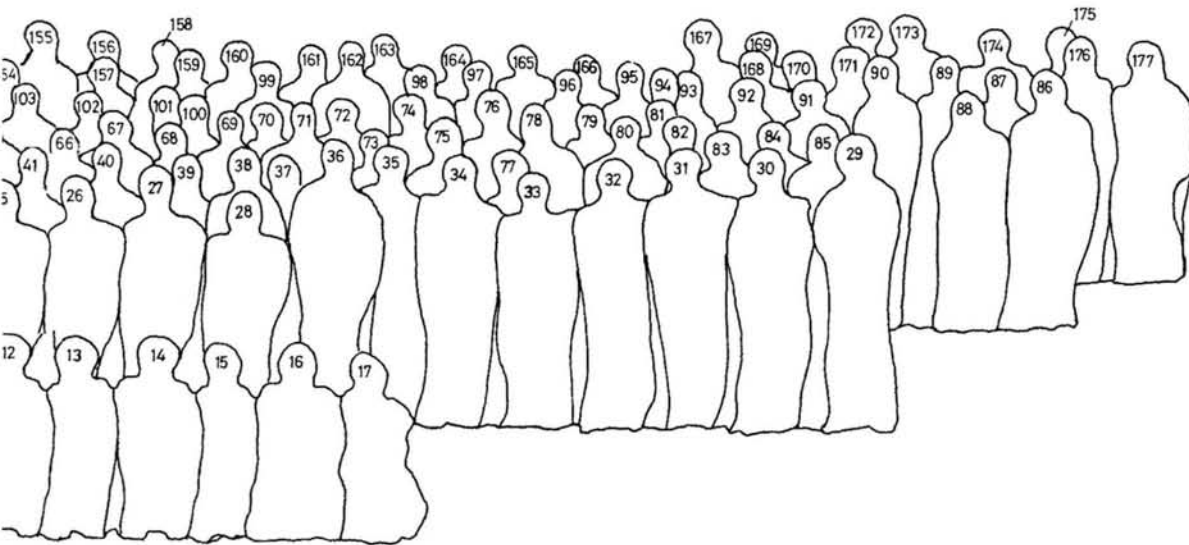
3. *Journal of Biosciences*, Vol. 19, Number 4, October 1994, pages 353–509. "Environmental and Hormonal Approaches to Ornithology".

In December 1991, a diverse group of Indian and foreign ornithologists gathered at HNB Garhwal University, Srinagar, Garhwal, to take part in the International Symposium on Environmental and Hormonal Approaches to Ornithology, sponsored by the Ornithological Society of India, UGC, DST and CSIR. This gathering of avian biologists was highly successful in the exchange of scientific results and ideas for future research as can be attested by examination of the selected updated papers appearing in this special issue. These papers span a broad spectrum from theoretical analyses to practical approaches of applied ornithology. The diverse topics covered in these papers include endocrinology, physiology, morphology, evolution, nutrients, ecology, conservation, behaviour and agricultural ornithology. This dazzling range of topics resulted in an exciting meeting. There were 54 excellent lectures and spirited discussions and the Srinagar

Participants at the Diamond Jubilee Meeting at Bangalore



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|----------------------|----------------------|-------------------------|-----------------------------|-------------------------|
| 1. Shantha Nair | 19. N. Viswanadham | 37. S.N. Sarkar | 55. A.P. Roy | 73. N.A. Narasimham |
| 2. N. A. Prakash | 20. R. Narasimha | 38. M.S. Vardya | 56. Probal Chaudhuri | 74. K.P. Sinha |
| 3. G. Chandramohan | 21. S. Ramaseshan | 39. B.A. Dasannacharya | 57. V.V.S. Sarma | 75. G.V. Subba Rao |
| 4. Peter Jayaraj | 22. S. Dhawan | 40. Virendra Singh | 58. B.C. Subba Rao | 76. Sarva Jit Singh |
| 5. G. Madhavan | 23. C.N.R. Rao | 41. C.K. Mathews | 59. N.S. Narasimhan | 77. Debashish Chaudhury |
| 6. M. S. Venugopal | 24. S. Varadarajan | 42. V. Kannan | 60. S.L.N.G. Krishnamachari | 78. K.T. Jacob |
| 7. R. Rangaswamy | 25. M.G.K. Menon | 43. Phoolan Prasad | 61. | 79. M.V. Bhatt |
| 8. A. Jayakumar | 26. T.S. Sadasivan | 44. T.M. Jacob | 62. D.R. Sikka | 80. V.V. Ranade |
| 9. H. Channaiah | 27. O. Siddiqi | 45. P.R. Pisharoty | 63. R. Jayaraman | 81. B.S. Ramakrishna |
| 10. P. Vijaya Kumar | 28. C.R. Rao | 46. P.G. Adyalkar | 64. R.K. Saxena | 82. N. Sathyamurthy |
| 11. L. Hanumanthappa | 29. B.K. Shivaramiah | 47. K.R. Anantharamaiah | 65. S.K. Sopory | 83. P.S. Rao |
| 12. P. Rajesh | 30. T.K. Roy | 48. C.V. Sundaram | 66. Sipra Guha-Mukherjee | 84. S. Ranganathan Tvm |
| 13. A. Nagaraj | 31. A.K. Ramdas | 49. K.R. Rao | 67. R. Kumar | 85. Darshan Ranganathan |
| 14. B. Sethumani | 32. T. Kailath | 50. B.L.S. Prakasa Rao | 68. K.K.G. Menon | 86. K. Shanthy |
| 15. C. Vedamurthy | 33. R. Ramachandran | 51. R.G. Rastogi | 69. S. Mitra | 87. Padma |
| 16. B. Krishna | 34. S.S. Jha | 52. P.S. Goel | 70. J.C. Bhattacharyya | 88. Hema Wesley |
| 17. R. Shyamala | 35. S.K. Ghosh, BARC | 53. G. Rajasekaran | 71. V.N.R. Pillai | 89. M. Srimathi |
| 18. V. Krishnan | 36. N. Panchapakesan | 54. D.P. Roy | 72. G. Swarup | 90. K.B. Sinha |



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|--------------------------|-----------------------|-------------------------|-------------------------|-----------------------------|
| 01. H.Y. Mohan Ram | 109. K.K. Mahajan | 127. H.R. Krishnamurthy | 145. C.R. Subrahmanya | 163. S. Ranganathan, B'lore |
| 02. H. Sharat Chandra | 110. S.M. Chitre | 128. D.N. Bose | 146. A.D. Patel | 164. S. Chandrasekaran |
| 03. S. Mazumdar | 111. B. Venkataraman | 129. Deepak Dhar | 147. N.V.G. Sarma | 165. G.S.R. Subba Rao |
| 04. M.V. George | 112. K.B. Misra | 130. E.D. Jemmis | 148. B.K. Godwal | 166. G. Mehta |
| 05. N.A. Shah | 113. S. Srikanth | 131. S. Banerjee | 149. N. Periasamy | 167. S. Dattagupta |
| 06. | 114. | 132. A. Srikrishna | 150. P.V. Kulkarni | 168. P.N. Rangarajan |
| 07. R. Gadagkar | 115. A.B. Roy | 133. S.K. Malik | 151. R.V. Bhonsle | 169. R. Balasubramanian |
| 08. N. Kumar | 116. B.M. Deb | 134. S.K. Bose | 152. G. Srinivasan | 170. N. Mukunda |
| 09. B.V. Sreekantan | 117. K.R. Shivanna | 135. P. Chaddah | 153. G.R. Desiraju | 171. S.R. Valluri |
| 10. N.V. Madhusudana | 118. C. Mande | 136. R. Uma Shaanker | 154. A.K. Sood | 172. M.A. Viswamitra |
| 11. A.K. Kshirsagar | 119. A. Surolia | 137. M.K. Chandrashekar | 155. M.R.N. Murthy | 173. R. Cowsik |
| 12. S.V. Subramanyam | 120. S.K. Brahmachari | 138. K.N. Ganeshaiyah | 156. Amit Patra | 174. K.S. Viswanathan |
| 13. U.C. Mohanty | 121. R. Nityananda | 139. V. Radhakrishnan | 157. P. Rama Rao | 175. C.G. Veena |
| 14. T.V. Ramakrishnan | 122. P.C. Vaidya | 140. J. Chandrasekhar | 158. P. Ramachandra Rao | 176. Chandrika Ramesh |
| 15. V.C. Thakur | 123. V.S. Borkar | 141. P. Balaram | 159. V.K. Gaur | 177. Ranjini Mohan |
| 16. A.S. Balasubramanian | 124. G.V. Narahari | 142. N. Chandrakumar | 160. P.A. Paranjpe | |
| 17. U.W. Kenkare | 125. R. Subrahmanyam | 143. D. Banerjee | 161. T.R. Anantharaman | |
| 18. C.J. Saldanha | 126. V.U. Reddy | 144. T. Ramasami | 162. R.A. Mashelkar | |

ornithological conference was a memorable one for all participants. The editors hope that the readers of this journal will be able to share the enthusiasm and exhilaration experienced by the members of the conference.

4. *Sadhana: Academy Proceedings in Engineering Sciences*, Vol. 19, Part 5, October 1994. "Computational Heat Transfer".

An important and active research area in engineering sciences is that of computational heat transfer. Considerable growth has occurred over the last three decades in numerical techniques and methodology applicable to heat transfer as well as in the variety of thermal problems considered. A wide range of complexities and problems are encountered due to the application of thermal sciences to diverse engineering disciplines, ranging from environmental, energy, aerospace and electronic systems to manufacturing and combustion processes. Consequently, there is a strong need to develop valid, accurate and versatile numerical schemes for simulating heat and mass transfer in complicated geometries, with realistic boundary conditions and with different material characteristics. Existing numerical methods have also been adapted to study different practical situations. Even though practical problems provide a major motivation for research in computational heat transfer, fundamental heat transfer processes such as convection, radiation and conduction are also of interest since many basic questions need to be answered and a better understanding of the underlying phenomena is needed in many cases. Areas such as turbulent transport, conjugate heat transfer, effects of strong material property variations, three-dimensional processes and problems with phase change need further work.

This special issue of *Sadhana* brings into focus some of the important aspects and techniques in computational heat transfer. The issue contains ten papers that cover many diverse and important topics. The subject area is a very vast one and it is not possible to consider all the different facets and techniques. However, this special issue of the journal strives to present some of the important research topics and the relevant numerical strategies which may be employed for obtaining accurate and valid solutions.

The diversity of this important and interesting area of research is brought out, along with different types of numerical approaches that are commonly used, such as finite difference, finite element, spectral and control volume methods. Modifications in traditional schemes to meet the challenges posed by complexities that arise in

practical problems are also brought out. The guest editors hope that this special issue will indicate the current trends and point out appropriate numerical methods for a variety of basic and applied problems in heat transfer.

5. *Proceedings Chemical Sciences*, Vol. 106, Number 5, October 1994. "Frontiers in Bioorganic Chemistry".

This special issue on "Frontiers in Bioorganic Chemistry" is organized around five themes of contemporary challenges in bioorganic chemistry. The specificity and selectivity in chemical and biochemical reactions is a consequence of non-covalent molecular forces which tune the physical interplay among the component molecules. A basic understanding of the rules which govern such interactions and the determinants of molecular recognition is essential for unraveling the chemical basis of biological complexity. The articles on supramolecular chemistry, role of hydrogen bonding in molecular self-assembly and delineation of hydrophobic contribution to molecular recognition in bio-relevant aqueous systems attempt to address some of these issues. The application of molecular recognition for influencing the rate and course of organic reactions is amply demonstrated in two independent contributions. The futuristic possibilities and practical utility of molecular cognition are exciting: control of molecular architecture through engineered molecular recognition, creation of functional materials and synthetic self-organizing systems, construction of chemzymes with high turnover capability and rational design of medicinal agents.

Ever since the discovery of the famous 'double helix' by Watson and Crick forty-one years ago, the search for multitudes of polymorphic structures for DNA and RNA continues unabated. This has resulted in discovery of triple helical and tetrameric DNA and several 'functional' motifs for RNA. The chemistry and biology of RNA are moving centrestage after the discovery of ribozymes. The articles on slipped loop DNA structure, rational design of nucleobases with improved stacking potential, recent advances in chemical synthesis and applications of RNA and synthesis of complex lariats relevant to RNA splicing models illustrate some challenging aspects. The chemical degradation of DNA is as important as its chemical synthesis due to its emerging applications in antigene/antisense technology.

Biology presents myriad challenges, many of which are amenable to chemical solutions. A

compelling consequence of this is an enhanced symbiosis of chemistry and biology. The editor hopes that the articles in this issue bear evidence of this.

6. *Proceedings Mathematical Sciences*, Vol. 104, Number 4, November 1994, pages 597–853. "Spectral and Inverse Spectral Theory".

The spectral theory of Schrödinger operators is a highly developed field and has given rise to many new mathematical techniques. Some of these find applications in the scattering theory in quantum mechanics. Some of these problems were discussed and a set of solutions were presented in the workshop "Spectral and Inverse Spectral Theory", organized by the Indian Academy of Sciences, Bangalore, during August 24–30, 1993, at the Kodaikanal Observatory of the Indian Institute of Astrophysics. This volume is a result of that effort. Attempts have been made by the editors to make this into a kind of review volume, with a few new proofs. It is intended to give an introduction suitable for advanced graduate students and also to serve as a convenient reference for researchers in the area.

7. *Bulletin of Materials Science*, Vol. 17, Number 6, November 1994, pages 563–1196.

To commemorate the Diamond Jubilee of the Academy the editors have brought out this special number. There are 56 invited research articles which cover many important areas of materials science and technology.

8. *Journal of Biosciences*, Vol. 19, Number 5, December 1994, pages 511–661. "Cell Biology".

The seventeenth annual meeting of the Indian Society of Cell Biology (ISCB) was held in the School of Life Sciences, Devi Ahilya University, Indore, in January 1994. The period of nearly two decades since the first official annual meeting of the society at Banaras Hindu University in 1977 has witnessed a substantial change in the perspective of research in cell biology. Much of the emphasis of present-day cell biologists lies in the exploration of the molecular basis of cellular events.

The nine research articles and reviews published in this special issue were presented as symposia lectures at Indore. The range of topics covered in these articles reflects the diversity of areas that came up for discussion. It also indicates the heterogeneity of interests among the participating scientists (which made the meeting

exciting). The articles in this issue cover only a part of the presentations made at the meeting and are far from being fully representative of the research activities of the larger community of cell biologists in this country. Publishing a selection of papers based on talks delivered in the annual meetings of the ISCB should allow an evaluation to be made of the scientific merits of these meetings. This first attempt in this direction augurs well for the future.

Raman Professor

Prof. A K Ramdas of Purdue University, Indiana, USA, was the twelfth Raman Professor of the Academy and was in India between November 1994 and January 1995. Prof. Ramdas has made extensive contributions on the optical phenomena exhibited by condensed matter. Employing a wide variety of spectroscopic techniques, his research has addressed the electronic band structure of semiconductors, the nature of impurity levels in semiconductors, and localized and collected excitations in phonons, plasmons and magnons.

Prof. Ramdas was a student at the Raman Research Institute working with Prof. C.V. Raman and obtained his M.Sc. and Ph.D. degrees. It so happens that both his grandfather, the late Prof. L.K. Ananthakrishna Iyer, and his father the late Prof. L.A. Ramdas who were founding Fellows of the Academy, had also worked with Prof. C.V. Raman. Ramdas was elected to the Academy in 1969.

During his visit as Raman Professor, Ramdas collaborated with students and faculty in the Physics Department of the Indian Institute of Science, Bangalore. He delivered a special lecture on diamonds at the Diamond Jubilee Meeting of the Academy in Bangalore on 2 December 1995. He also delivered lectures at the Raman Research Institute, Indian Institute of Science, National Aerospace Laboratories and at other places in Bangalore. He visited the Tata Institute of Fundamental Research and Bhabha Atomic Research Centre at Bombay, the National Chemical Laboratory and University of Poona at Pune, the Delhi University, the Indira Gandhi Centre for Atomic Research in Kalpakkam, the University of Madras, etc., and delivered lectures.

Obituaries

Ayroorkuzhiyil Abraham was born on May 25, 1914 in the then State of Travancore. He had his preparatory and high school education in Government schools. In 1929, he joined the College of Science, Trivandrum, for the Intermediate course and in 1931 shifted his university studies to the Presidency College, Madras. In 1933, he obtained the B.Sc. degree and in 1935, the M.A. degree in botany. In both the University examinations, he stood first. In 1937, he took the M.Sc. degree from the University of Madras after two years of research work in plant cytology. From July 1937 to July 1940 he was on the staff of the Madras Christian College. From July 1940 to July 1942, he held the post of assistant cytologist in the College of Agriculture at Poona. In July 1942, he was appointed as economic botanist in the Central Research Institute of the Travancore University, which post he held until he left India for the U.S.A. in November 1945.

In January 1946, he joined the Cornell University and worked for his Ph.D. under the guidance of Prof. H.H. Smith in the plant breeding department. There, he also had the opportunity to study under such eminent teachers as Prof. H.H. Love, Prof. L.W. Sharp and Prof. A.J. Eames. His thesis entitled "*Nicotiana langsdorffii*" will always be remembered as an outstanding pioneer work in this field.

On his return from the United States, after a few profitable years as research officer in the state government and Professor and Head of the Department of Botany in the University College, he was appointed as the Head of the Department of Botany, University of Kerala. Abraham's realization of the importance of Botany and especially genetics and plant breeding culminated in the starting of the M.Sc. botany courses in many of the affiliated colleges and the M.Sc. genetics and plant breeding course in the university Department of Botany. As an eminent educationist, he realized that the present-day botanist should have some knowledge of biophysics, biochemistry and statistics and included all these disciplines in the M.Sc. genetics and plant breeding course. His leadership during the formative period of the department was of immense value to the department. He was an eminent teacher and research worker and during the period of his headship, the department of botany achieved

reputation as a centre of excellence in teaching and research.

In 1972, he was appointed as the first chairman of the Kerala State Committee on Science and Technology, which post he held till he left India as an Officer of the Food and Agriculture Organization of the U.N. In 1976, on return from his assignment, he continued as chairman of the State Committee on Science and Technology.

He was conscious of the need for the preservation and effective utilization of our genetic wealth. His vision and interest in maintaining germplasm collections of plants culminated in the establishment of the Tropical Botanic Garden and Research Institute at Palode, Trivandrum, where he served as its first Director from 1979–1983. During this period, he procured 500 acres of land for the establishment of the Institute, established contacts with the Royal Botanic Gardens at Kew, U.K., initiated construction of the orchid house to exhibit the large collection of orchids which he assembled from different countries and established a tissue culture laboratory. Abraham's work on tapioca and other tuber crops since 1942 and the wide collection of root and tuber crops assembled by him through schemes supported by ICAR, state government and P.L. 480 provided the inspiration for the starting of the Central Tuber Crops Research Institute at Sreekaraiyam, Trivandrum. He was elected a Fellow of the Academy in 1957.

Prof. Abraham was a very able administrator. He was an extremely active scientist who could always find time to discuss and debate scientific problems with others. He was a remarkable person with deep devotion to science and helpfulness to fellow human beings. He will always be remembered as a leading plant cytogeneticist of our time and his loss has left a great gap. He passed away on 20 May 1994 at Trivandrum, leaving behind his wife and four children and a host of friends and colleagues to mourn his loss.

Andre Lwoff who died on 30 September was one of the fathers of molecular biology. He began his scientific life at the age of 19, and during the course of his career made a major contribution to the transformation of biology from a collection of dispersed disciplines into a single, unified science. In 1965, together with Jacques Monod and Jacob he was awarded the Nobel Prize in Physiology or Medicine for "discoveries concerning the genetic control of enzyme and virus synthesis".

Andre Lwoff was born to parents of Russian origin; his father was a psychiatrist, and his mother a painter and sculptor. His taste for research was probably influenced by his father who in the late 19th century, had had to escape from oppression by the Tsarist regime like many progressive people of the time. His father believed unshakably in science, and particularly in Darwinism.

When Andre Lwoff started in biology, he worked under a great protozoologist, Edouard Chatton, and was fascinated by the beauty and the strangeness of the forms that appeared under the microscope. At the age of 20, he entered the Pasteur Institute, in the laboratory of Felix Mesnil, who had been the secretary of Pasteur himself. During the 1930s, Lwoff spent time in two centres of biochemistry (with Otto Meyerhof in Heidelberg and David Keilin in Cambridge) and in 1938 became head of the Service de Physiologie Microbienne located in the attic of the Pasteur Institute. During the first year of the war, he was in the army. He then came back to the institute, for his laboratory became an active centre of the Resistance, and only at the end of the war did he resume serious scientific research. In 1959, he was appointed professor of microbiology of the Sorbonne.

Successively a protozoologist, a bacteriologist, a biochemist, a geneticist and a virologist, Lwoff produced a substantial scientific opus that includes two main discoveries. The first was to do with the status and role of vitamins. To multiply, some microbes required traces of certain compounds which other microbes do not need. Before the war, Lwoff showed that these compounds – vitamins – are actually components of all living organisms. They are indispensable to life. If some organisms but not others require vitamins in their culture medium, it is because the latter but not the former are able to manufacture them. This was a far-ranging discovery – with the results stemming from the work of biochemists, which showed that the same molecules with the same functions are found throughout the living world.

The second discovery was the demonstration that the genetic material of a virus, a bacteriophage, can become a component of the genetic make-up of the host bacterium. The whole progeny of this bacterium inherits the virus and the host cell can be broken by treatments which force the cell to produce virus particles. This notion underlies much of today's work on cancers and retroviruses.

Andre Lwoff had few students. He liked to work by himself, with the help of his wife

Marguerite, and of a technician and one or two collaborators (who, after the war, included Jacques Monod, Elie Wollman, Pierre Schaeffer and Jacob).

A real Renaissance man, Andre Lwoff liked to paint, especially in his later years, and he also wrote several books (*L'Evolution Physiologique*, *L'Ordre Biologique* and *Jeux et Combats*). He functioned more by intuition than by method, and practised science as an art. Indeed, this great scientist was above all an artist.

Palamadai Sundaram Narayanan was born on 1 January 1926. After getting his B.Sc. (Hons) degree from the Madras University, he joined the Department of Physics, Indian Institute of Science, in 1947 and obtained his Ph.D. degree in 1951. His early work was on Raman spectroscopy of crystals using the resonance radiation of mercury. His experimental studies on the second order Raman spectra of the alkali halides were of importance in understanding the lattice dynamics in these crystals.

His interest later shifted to the growth and study of ferroelectric crystals. He set up various facilities for growing a variety of ferroelectric crystals and studied their dielectric thermal expansion and infrared and Raman spectra as a function of temperature and pressure. Among the materials studied were crystals of the alkali tri-hydrogen selenite family, dicalcium strontium propionate, and several double sulphates. His group found interesting correlations between the nature of the hydrogen bonds, the dielectric anomaly and the anisotropy of thermal expansion. Careful studies were made by his students on the effect of deuteration, pressure and radiation damage in the hydrogen bonded ferroelectrics. Studies on laser Raman spectroscopy of various ferroelectric materials provided valuable information on the mechanism of phase transition in these crystals.

He later moved to the study of nonlinear optical properties of organic dye solutions and their use in optical phase conjugation. He and his students made a systematic study of thermally induced DFWM (degenerate four wave mixing) in dye solutions to study the effect of concentration, the influence of the solvent and its properties and the effect of varying the interaction angle and probe beam intensities on the phase conjugate reflectivities. Studies on Raman-induced phase conjugation (RIPC) were carried out by his group. In RIPC phase matching among the four beams in non-degenerate four wave mixing can be achieved for a given beam geometry over a wide range of excitation

frequencies. Phase matching can also be achieved for given beam frequencies for a wide range of input or 'image' beam angles. The stimulated Brillouin scattering gain was measured in halogenated methanes and compared with calculated values in a study of optical phase conjugation by stimulated Brillouin scattering. A novel approach for phase conjugate interferometry using a composite material which contains both a photorefractive crystal and dye-doped polymer thin film in a degenerate four wave mixing geometry has been reported by his group.

He was the principal investigator for several projects sponsored by different funding agencies. He set up a laser Raman facility at the Indian Institute of Science, Bangalore, with DST support and carried out his research on optical phase conjugation with financial support from the Defence Research and Development Organization.

He served the Department of Physics of the Indian Institute of Science as a professor from 1971 to 1986. He also held several administrative positions such as Dean of the Science Faculty, Professor-in-charge of the Department of Physics and Chairman, Division of Physical and Mathematical Sciences in the Indian Institute of Science during different periods of time.

Over a period of about forty-seven years of sustained research, Narayanan has trained over thirty-five research scholars in crystal growth, ferroelectricity, laser Raman spectroscopy, and optical phase conjugation. He was a gifted experimentalist who devoted his time and effort to carry out systematic and painstaking research in areas which might not have been currently fashionable. He was elected a Fellow of the Academy in 1974. He was a sectional president in Physics of the seventy-third Indian Science Congress in 1986.

In the last few years his health became frail. Recently he underwent a kidney transplant operation. Within a short period after the operation he passed away on 23 October 1994.

Ramavarma Raghu Prasad was born on 17 December 1920. After he took his B.Sc. degree in 1940 from the University of Travancore and his M.Sc. degree by research in 1943 from the University of Madras he underwent a Fisheries Training Programme at the Madras Fisheries Department. He took his Ph.D. degree from Stanford University in 1947. On return to India from the United States on completion of the Ph.D. programme sponsored by the Government

of India, he joined the Central Inland Fisheries Research Institute in Barrackpore under the Ministry of Food and Agriculture as Assistant Research Officer, and in 1940 came over to the Central Marine Fisheries Research Institute as Research Officer in Marine Biology. Later, in 1956 he became a senior Research Officer and was elevated in 1962 as the Deputy Director of the Institute in which position he served until 1968 when he was called upon to the headquarters of the Indian Council of Agriculture in New Delhi to take up the leadership as the Deputy Commissioner/Assistant Director General (Fisheries) from which position he retired in 1981. He served as Emeritus Scientist of the ICAR till 1992.

During his tenure as the Deputy Director in the Central Marine Fisheries Research Institute, he also served as part-time Advisor/Consultant to the National Institute of Oceanography in Cochin. He was elected a Fellow of the Academy in 1958.

His scientific work was largely confined to biological oceanography and fisheries, particularly marine plankton and larval life of lobsters. He passed away on 20 July 1994.

George Series was an outstanding university teacher, leader of research, and college tutor. Born at Bushey in Hertfordshire, he was a small child when his parents moved to Stratfield Saye in Berkshire where he won a scholarship to Reading School. In 1938 he gained an Open Scholarship to St John's College, Oxford, but his studies were interrupted by the Second World War. He saw service with the Friends Ambulance Unit in Egypt, Italy and in Yugoslavia, where characteristically, he stayed to complete his work although this delayed his return to Oxford to 1945. Then, in two years he took a First in Physics.

Always quiet, calm, courteous but incisive, he had the ideal temperament for scientific research, starting with high resolution optical spectroscopy of the hydrogen atom and of ionized helium. His supervisor was H.G. Kuhn, with whom he continued as a post-doctoral colleague.

In 1950 he was appointed a Nuffield Research Fellow, becoming a university lecturer a year later. With Kuhn he modernized the optical and spectroscopic experiments on the undergraduate practical course in the Clarendon Laboratory. He became a lecturer at St Edmund Hall in 1953, then a fellow from 1954 to 1968, when he was appointed Professor of Physics at Reading University.

In Oxford, after a demonstration of the Lamb shift in ionized helium as a splitting of the spectral lines, he applied the technique of optical-radio-frequency double resonance to excited states of atoms. An experiment on the hyperfine structure of potassium produced a "first", a determination of the nuclear electric quadrupole moment.

Wide-ranging research work then included studies of the coherent scattering of resonance radiation, light beats, "level crossing" techniques and resonance intensity correlations in double resonance experiments. At Reading this work continued with theoretical studies and the application of tunable lasers to novel spectroscopic measurements. He published two books: *The Spectrum of Atomic Hydrogen* (1957) and *Laser Spectroscopy and other Subjects* (1985).

His research was recognized by the award of a doctorate of science from Oxford University in 1969, and two years later he was elected a Fellow of the Royal Society. In 1972 Series was William Evans Visiting Professor at the University of Otago, New Zealand, and his international reputation continued to grow. Between 1970 and 1975 he was elected to fellowships of the Royal Astronomical Society, the American Physical Society and the Optical Society of America.

In 1982 he received the Meggers Award and Medal of the Optical Society of America and was appointed Raman Visiting Professor of the Academy. He visited Bangalore as Raman Professor during October 1982 to February 1983. He was elected an honorary fellow in 1984.

For many years he acted as a governor of Reading School as representative of the University of Oxford and of Bearwood College, the Royal Merchant Navy School. He was an honorary editor of the *Journal of Physics B (Atomic & Molecular Physics)*.

He passed away on 2 January 1995. He is survived by his wife Annette, three sons and a daughter and a lot of friends and colleagues to mourn his death.