57th Annual Meeting

At the invitation of the National Chemical Laboratory, Pune, the 57th Annual Meeting of the Academy was held at Pune from 8 to 11 November 1991.

The Meeting began with the inaugural session on the morning of Friday, 8 November at the National Chemical Laboratory (NCL) Auditorium. Dr R A Mashelkar, Director, NCL welcomed the delegates. Since the Academy held its last meeting in Pune in 1983, a ‘Research Belt’ had come into being in Pune, consisting of the Poona University, the Centre for Development of Advanced Computing (C-DAC), the National Informatics Centre (NIC) (Western Region), the Inter-University Centre for Astrophysics and Astronomy (IUCAA), the National Centre for Radio Astrophysics (NCLA), the National Institute of Virology (NIV), the Indian Institute of Tropical Meteorology (IITM), the Armament Research and Development Establishment (ARDE), the Explosives Research and Development Laboratory (ERDL) and the Mechanical Engineering Research and Development Organization (MERADO). All these research institutions located on Homi Bhabha Road were involved in organizing the 57th Annual Meeting.

Prof. C N R Rao, President of the Academy spoke of the traditions established by its founder, Professor Raman, and of the aims of the Academy. He next introduced the Fellows and Associates present to the audience – a time-honoured custom established by its Founder-President. He then delivered the Presidential Address related to his research in the areas of “Metal Clusters and Molecular Carbon Balls”.

The first session was a Discussion Meeting in the afternoon of 8 November 1991 on “Doing Science in India: Problems, Limitations and Challenges” under the chairmanship of Prof. C N R Rao. There were 7 main speakers: A Chakravorty, R Chidambaran, R Jayaraman, D Balasubramaniam, R A Mashelkar, N Mukunda and R Narasimha and 8 speakers from the audience. Prof. C N R Rao led the discussion. He was of the view that the experimental work in both chemistry and physics was poor.

A Chakravorty spoke of the mammoth contradictions that exist. R Chidambaram while agreeing with C N R Rao about the poor quality of experimental physics, remarked that the velocity of R and D is much lower in India than elsewhere, due to bureaucratic procedures, apathy on the part of scientists in accepting conditions as they are, the lack of adequate peer groups, poor interaction between scientists, poor access to knowledge and information and the difficulties in travel, particularly to attend international conferences. One of the main drawbacks was our value system and the import of equipment with not enough indigenous development of instruments. Another shortcoming was the lower value placed on applied science and scientists, when compared to basic sciences. R Jayaraman pointed out how scientists in universities are looked down upon by others and how problems in the seventies and eighties are completely different. After 1980, when DST identified thrust areas in research and after the Baroda meeting on Biology which marked a turning point in research in Biological Sciences, the situation had improved considerably. He also spoke of the disappointing lack of dedication among the younger scientists and of the difficulties faced by scientists in speedy publication of papers, availability of perishable and other materials, etc.

D Balasubramaniam presented a brighter picture and said that it was far easier to work in biophysics in India than elsewhere. He quoted the example of G N Ramachandran and the vibrant school he built. R A Mashelkar also
was more optimistic. While the growth in industrial research was brisk, this was not, however, synonymous with technological development. He said that industrial R and D is poor at present, though India is the largest producer of sugar, bicycles, fans, sewing machines etc.; our technology is archaic because of protection and lack of competition. He spoke of motivating fresh science graduates to do industrial research and of accountability and how there must be a change in our attitudes and healthy competition in industry. N Mukunda spoke of the need for a minimum and continuous high quality work.

The speakers from the audience spoke of the problems they face. P R Pisharoty summed up the feelings of many in the audience when he listed the essential ingredients for good science as ambition, courage and hard work. The session came to a close with a concluding speech by the Chairman.

A symposium on “Extragalactic Astronomy and Cosmology” was held in the forenoon of Saturday, 9 November under the chairmanship of Prof. R Cowsk. A brief report on the symposium is given in this issue.

There were 12 lecture presentations by Fellows and Associates in the afternoon of Saturday, 9 November and in the forenoon of Monday, 11 November.

The first session under the chairmanship of Prof. R Kumar consisted of three talks. S K Ghosh of Bhabha Atomic Research Centre, Bombay spoke on the “Density description of many-electron systems”. He showed that the density functional theory not only leads to computational economy due to its single-particle framework, but also provides a rigorous foundation and important generalizations of several widely used chemical concepts like electronegativity, hard soft acid base, valency etc. P K Chattaraj of Indian Institute of Technology, Kharagpur next spoke on “Non-linear chemical dynamics”. He described the quantum fluid density functional theory that he had developed to study the ion-atom collision and atom-field interaction problems in terms of different time-dependent properties. The last talk of the session was by T P Radhakrishnan, University of Hyderabad, who spoke on “Spin coupling in non-Kekulé systems and organic ferromagnetism”. He critically reviewed the various models proposed during the last two decades to achieve ferrimagnetic or ferromagnetic coupling of spins in organic system, if not ferromagnetic ordering.

The second session was held that afternoon under the chairmanship of Dr S Varadarajan. B J Cherayil of the Indian Institute of Science, Bangalore spoke on “Starburst polymers” and some of its general features. The second talk was by K Kishore of the Indian Institute of Science, Bangalore on “Kauzmann’s paradox and configurational entropies in long chain molecules”. He described the glass-forming attributes of long chain molecules (mol. wt. 300–1000).

The Evening lecture on 9 November at the Fergusson College Auditorium was given by Dr Deepak Nayyar, Chief Economic Adviser and Secretary, Ministry of Finance, Department of Economic Affairs, New Delhi, on the “Crisis in the Economy”. A brief abstract of his lecture is reproduced in this issue.

The first talk in the third session on Monday, 11 November under the chairmanship of Prof. E S Raja Gopal, was by M Lakshmanan of Bharathidasan University, Tiruchirappalli on the “Analytic structure of integrable and chaotic dynamical systems”. He spoke of how the concepts of soliton and chaos have revolutionized our understanding of dynamical systems in recent times. These nonlinear dynamical systems possess a multitude of mathematical properties, where analysis is imperative to the understanding of their physical properties.

The next talk was by Y Singh, Banaras Hindu University, Varanasi on “Behaviour of excess electrons in a classical bath”. The last talk in this session was by S V Subramanyam, Indian Institute of Science, Bangalore on “Unusual properties of low-dimensional systems”. He gave examples of low-dimensional electrically conducting systems which have unusually large anisotropy in electrical conductivity. The studies were carried out in a miniature high pressure cell in which electrical conductivity measurements can be made at pressures of 8 GPa, temperature down to 1 K and magnetic fields up to 7 Tesla.

The last session under the chairmanship of Prof. S S Jha had four speakers. A K Sood, Indian Institute of Science, Bangalore spoke on “High pressure spectroscopy of C_{60} and other novel systems”. The next talk was by Darshan Ranganathan of the Indian Institute of Technology, Kanpur on “The design of novel chemical models for enzyme action”. She described how the understanding of some of the most vital biological operations of nature, at a molecular level, and the design of chemical models to simulate these, have provided novel concepts in synthetic organic chemistry.

The last two talks were by S K Brahmachari, Indian Institute of Science, Bangalore on “Structural motifs in DNA as regulatory signals” and G Shanmugam, Madurai Kamaraj University, Madurai on “Cell cycle regulation”.

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Brahmachari spoke of the novel approach used by him to delineate the DNA structural elements responsible for regulation of gene expression in vivo. Shanmugam described mammalian cell cycle regulation mechanisms.

The Annual Meeting came to a close with concluding remarks by Prof. S S Jha and Prof. H Sharat Chandra.

A full day excursion to Mahabaleshwar was organized on Sunday, 10 November. The Business Meeting of Fellows was held at Green Hill Campus, Mahabaleshwar, before a visit by the delegates to Old Mahabaleshwar and Arthur Seat Point via Elphinstone Point and Echo Point.

Six short talks were given during the Business Meeting. These were by V K Gaur on the recent earthquake in northern India and the underlying causes, by R Chidambaram, who described the nuclear reactor programme in the country and its potential in such areas as power reactors, cancer therapy, etc, by M Vijayan, who spoke of the research being done by his group in Bangalore in the field of protein and virus crystallography, by R K Varma, who described the recent results obtained by his group which shows violation of the well-known theory of motion of charged particles, by K Gopalan, who pointed out the scientific significance of rocks and by D R Sikka, who spoke on medium range weather forecasting with the help of super computers.

There was a delightful evening of music and drama, on 8 November, when Gashiram Kotwal, a Marathi play, was staged by the Theatre Academy, Pune at the Balgandharva Theatre.

140 Fellows and 12 Associates attended the Meeting. The group photograph taken at the National Chemical Laboratory on 8 November is reproduced on pages 8 and 9.

The organization and arrangements for the scientific meetings, cultural event and excursion were superb. The Academy is grateful to the National Chemical Laboratory, particularly Dr R A Mashelkar, Director, NCL and his colleagues especially Dr S Devotta, Local Organizing Secretary who made the Meeting the splendid success it was. Our special thanks are due to G Swarup and V K Kapahi who organized the symposium on "Extragalactic Astronomy and Cosmology".

Council for the Triennium 1992–94

The outgoing Council held an election in December 1991 to constitute the Council for the next triennium 1992-94. The composition of the new Council is as follows:

- R Narasimha, National Aeronautical Laboratory, Bangalore – President
- C N R Rao, Indian Institute of Science, Bangalore – Past President
- A N Bhaduri, Indian Institute of Chemical Biology, Calcutta
- D Chakravorty, Indian Association for the Cultivation of Science, Calcutta
- M K Chandrashekaran, Madurai Kamaraj University, Madurai
- R Chidambaram, Bhabha Atomic Research Centre, Bombay – Vice-President
- V K Gaur, Department of Ocean Development, New Delhi
- Indira Nath, All India Institute of Medical Sciences, New Delhi
- S S Jha, Tata Institute of Fundamental Research, Bombay
- V Krishnan, Indian Institute of Science, Bangalore – Secretary
- R A Mashelkar, National Chemical Laboratory, Pune
- G Mehta, University of Hyderabad, Hyderabad – Vice-President
- R Nityananda, Raman Research Institute, Bangalore
- G Padmanaban, Indian Institute of Science, Bangalore – Vice-President
- V Radhakrishnan, Raman Research Institute, Bangalore – Treasurer
- P Rama Rao, Department of Science and Technology, New Delhi – Vice-President
- K B Sinha, Indian Statistical Institute, New Delhi
- G Srinivasan, Raman Research Institute, Bangalore – Editor of Publications
- M Vijayan, Indian Institute of Science, Bangalore
- N Viswanadham, Indian Institute of Science, Bangalore – Secretary
Honorary Fellows
elected in 1991

J T Bonner, Princeton University, Princeton, New Jersey, USA
G Neuwelier, Ludwig-Maximilians Universität, München, Germany
H Ratajczak, University of Wrocław, Wrocław, Poland

Fellows elected
in 1991

Asha Chandola–Saklani, Garhwal University, Srinagar, Garhwal for her studies of the reproduction and migration in birds etc.
D Banerjee, Defence Metallurgical Research Laboratory, Hyderabad for his studies in electron microscopy and titanium metallurgy
S K Basu, National Institute of Immunology, New Delhi, for his work in immunology
J Chandrasekhar, Indian Institute of Science, Bangalore, for his theoretical studies of structure and reactivity in organic compounds
R V Chaudhari, National Chemical Laboratory, Pune, for his contributions to the studies of catalysis
B M Choudary, Indian Institute of Chemical Technology, Hyderabad, for his work on catalysis
C Dasgupta, Indian Institute of Science, Bangalore, for his theoretical studies of disordered systems and phase transitions
A C Dash, Utkal University, Bhubaneswar, for his work in transition metal chemistry
A Datta, Jawaharlal Nehru University, New Delhi, for his contributions in molecular biology
S Dattagupta, Jawaharlal Nehru University, New Delhi, for his studies of non-equilibrium relaxation phenomena

K N Ganeshaiah, University of Agricultural Sciences, Bangalore, for his work in plant evolutionary biology
S N Ganguli, Tata Institute of Fundamental Research, Bombay, for his contributions in experimental high energy physics
R M Godbole, University of Bombay, Bombay, for her work in theoretical particle physics
P S Goel, ISRO Satellite Centre, Bangalore, for his work in satellite technology
Gomathy Gopinath, All India Institute of Medical Sciences, New Delhi, for her contributions to neurobiology
J N Goswami, Physical Research Laboratory, Ahmedabad, for his work on the solar system, particularly meteorites
J Gowrishankar, Centre for Cellular and Molecular Biology, Hyderabad, for his studies in bacterial genetics
E D Jemmis, University of Hyderabad, Hyderabad, for his work in theoretical chemistry
N V Joshi, Indian Institute of Science, Bangalore, for his studies in population genetics and sociobiology
V Kannan, University of Hyderabad, Hyderabad, for his work in topology and functional analysis
K Kesava Rao, Indian Institute of Science, Bangalore, for his contributions in chemical engineering particularly the flow of powders
D Mathur, Tata Institute of Fundamental Research, Bombay, for his work in experimental atomic and molecular physics
M R N Murthy, Indian Institute of Science, Bangalore, for his contributions to virus crystallography
K Nag, Indian Association for the Cultivation of Science, Calcutta, for his work in transition metal chemistry
R Nagaraj, Centre for Cellular and Molecular Biology, Hyderabad, for his studies of membrane biochemistry
S B Ogale, University of Poona, Pune, for his work on ion and laser processing of materials
Crisis in the Economy

Summary of the Evening Lecture on “Crisis in the Economy: Problems of Adjustment and Transition” given by Dr Deepak Nayyar, Chief Economic Adviser and Secretary, Ministry of Finance, Department of Economic Affairs, New Delhi on 9 November 1991 at the 57th Annual Meeting of the Academy held at Pune.

Elaborating on the government’s radical liberalization policies and its fallouts, he said that the scientific community’s dependence on the State would have to remain, as the private sector was incapable of encouraging and sustaining basic research. Although the government was committed to ensure that the breeze of liberalization blew over all spheres of economic activities in the country, science and technology was one area which could not be exposed to uncertainties and the pulls and pressures of the market place. However, there was a necessity for encouraging a greater symbiotic relationship between the scientific community and Indian industry, for translating research into products. Advances in science and technology ought to be removed from the confines of the laboratories and commercialized. Dwelling on the flaws of the existing system, he said that it was imperative to spawn a new breed of entrepreneurs in the country who could form a link with the practitioners of science. He reassured scientists that the allocations to national laboratories and institutions of basic research would continue without any hitch. However, he pointed out that, over the years, technology imports had been absorbed but not adapted. Innovative breakthroughs and displays of innovative endeavours were rare and this trend needs to be reversed, for India could ill-afford to be technology followers in all areas. The effects of the governmental reforms would unwittingly creep into the scientific arena too and one could expect upheavals in the near future, compounding the technological problems.
Extragalactic Astronomy and Cosmology

The 57th Annual Meeting featured a symposium on extragalactic astronomy and cosmology, areas which happen to be of great interest to IUCAA (the Inter-University Centre for Astronomy and Astrophysics) and NCRA (the National Centre for Radio Astrophysics, of TIFR), two institutions located in Pune. The chairman of the session, R Cowsik of TIFR, Bombay, gave a brief introduction to the development of the subject over the last few decades. V K Kapahi of TIFR then described efforts to locate galaxies at great distances (equivalently, at high redshifts or early in the evolution of the universe). These searches have given spectacular results in the last few years where carefully selected radio sources are used as beacons to guide the observer to such young galaxies. Two teams with members at the NCRA/TIFR have played an important role in finding and studying these objects. The extended and distorted spatial shapes, measured spectra, and many other properties of these galaxies are the subject of intense theoretical and observational study.

The next talk, by T Padmanabhan of TIFR, Bombay, focussed attention on the confrontation between cosmological models and several crucial observations. These include the early formation of galaxies, the spatial correlations in their positions, their large scale velocities, and the deviations from uniformity of the cosmic microwave background radiation. Exhibiting all these constraints on a single diagram of mass contrast versus length scale, he made the point that every current model faces difficulties.

The talk by R Nityananda of the Raman Research Institute concentrated on the nonlinear dynamical processes which shape the initial perturbations into galaxies as observed today. The most recent work naturally involves large scale computing to get quantitative results. Many processes like clustering, collisionless relaxation, caustic and shock formation can, however, usefully be described in physical terms, and gravity plays a prominent role in most current theories.

G Swarup of NCRA described observational efforts to detect neutral atomic hydrogen in the universe by radio observations as well as the significance of this area. Some of their own work has given upper limits while very recently a detection has been claimed. Half of his talk was devoted to the efforts to build the Giant Metre wavelength Radio Telescope at a site north of Pune. This powerful instrument is expected to make a significant contribution to observational cosmology.

N Panchapakesan of Delhi University brought out the very fascinating connections between physics at the shortest possible scales, viz. particle physics and cosmology. In a sense the classical work on the synthesis of the light chemical elements comes in this category but the subject has seen a resurgence with the study of phase transitions in the early universe. These have implications for the idea of inflation—exponentially rapid expansion at an early stage—as well as baryogenesis—the development of differences between the numbers of particles and antiparticles.

The final talk by J V Narlikar of IUCAA started with the well-known successes of the 'big bang' model and went on to list its shortcomings. One argument was that the lack of detected anisotropy of the microwave background radiation implied a more recent origin after galaxies had formed. He criticized the trend of attributing associations between objects of widely differing redshifts to gravitational lensing as "bad science" and suggested that alternative mechanisms for redshifts should be explored. There was a lively discussion, during which it was urged that the gravitational lens model had made successful predictions and that more recent origins for the background radiation might lead to stronger conflicts with observations than the big bang models.

It was clear from the session that this area will see many interesting observational and theoretical developments in the years to come.

An International Seminar on Direct Nuclear Reactions was held in Bangalore during 12–16 January 1989, soon after the International Conference on Nuclear Reaction Mechanisms held in Calcutta during 3–9 January 1989. Organised by the Bangalore University, the Conference had as its aim a review of the current trends in the experimental and theoretical aspects of direct nuclear reactions initiated by light and heavy ions.

This volume was prepared as a tribute to G.N. Ramachandran, who has made seminal contributions to diverse areas of X-ray crystallography, conformational analysis of biomolecules, fibrous protein structures and three-dimensional image reconstruction. He has been the driving force behind the development of crystallography and molecular biophysics in India. This Festschrift is an acknowledgement of his dominant role in shaping biological research in the country.

There are 43 papers on a wide range of topics, from Analysis and Prediction of Protein Structures, Protein Structure and Function, Nucleic Acids and Drug Interactions, Molecular Recognition, Peptide Conformation and Design, Peptides as Biological Models to Membrane Transport and Viruses and Cellular Metabolism.


The present volume contains the texts of the 38 invited talks and 12 contributed papers which were presented at the Conference under six main topics—nuclear reactions at high energies, heavy-ion reactions, elastic scattering, inelastic scattering and charge-exchange reactions with light ions, transfer reactions with light ions (experimental and theoretical), knockout, break-up and fragmentation reactions.

In addition to a subject index and an author index, the volume also gives a list of participants of the Conference.


Prof. John Tyler Bonner has been in the Princeton University since 1947 and was the George M. Moffett Professor at the Department of Ecology and Evolutionary Biology of the University since 1966 till his formal retirement in 1990. This volume has been brought out to commemorate his visit to India as the Raman Professor of the Academy from October 1990 to January 1991.

As mentioned in the Foreword, John Bonner, more than anyone else, has been responsible for the recognition that the Cellular Slime Moulds constitute an ideal system for many of the problems of developmental biology.

The present collection of selected papers by John Bonner is a survey of his publications and contains 46 selected papers published during the last 45 years from 1944 to 1989. He has shown that developmental patterns are the result of
Participants at the 57th Annual Meeting held at Pune

1. V Radhakrishnan
2. P Rama Rao
3. D V Bal
4. S S Jha
5. V Krishnan
6. S Varadarajan
7. C N R Rao
8. R A Mashelkar
9. P R Pisharoty
10. A Mani
11. M S Vaiithan
12. R Narasimha
13. B D Tilak
14. V G Bhide
15. Darshan Ranganathan
16. S K Ghosh
17. P G Adyalkar
18. B K Nayar
19. T Pradhan
20. S Banerjee
22. K K Mahajan
23. Prem Narain
24. B M Deb
25. B S Chauhan
26. F Ahmad
27. D V S Jain
28. D D Awasthi
29. J Shankar
30. K Kasturirangan
31. M L Munjal
32. B C Subba Rao
33. C R Narayan
34. A M Kayastha
35. L Hanumanthappa
36. A Nagaraj
37. G Madhavan
38. Sandhya S. Vishweshvariah
39. S K Ghosh
40. T Ramakrishnan
41. S Biswas
42. M Rathnam
43. S Mazumdar
44. Sudha G Gangal
45. K D Abyankar
46. S Krishnan
47. R N Singh
48. K S Gandhi
49. P K Das
50. H O Agrawal
51. Rama
52. Anand Mohan
53. M R Raghavendra Rao
54. J V Narlikar
55. D Balasubramanian
56. P K Malhotra
57. R Ananthakrishnan
58. A V Khare
59. R Chidambaram
60. G S R Subba Rao
61. S Rajappa
62. S K Sikka
63. K R Rao
64. Y Singh
65. S C Dutta Roy
66. A Sridharan
67. K K G Menon
68. R N Iyengar
69. M Vijayan
70. U W Kenkare
71. S V Subramanyam
72. K Kishore
evolution—what evolves is a life cycle as a whole, not a phenotype in “bits and pieces” and that growth and form must have been of prime importance in the evolution of differentiation. Motivated perhaps by his own experiments on social amoebae, he has examined, from the view point of an evolutionary biologist, more complex social interactions, leading all the way to the evolution of culture.

The present collection is a must for cellular slime mould fans and also for everyone interested in getting acquainted with the central questions which have guided research on this remarkable developmental system.

### Special Issues of Journals


The International Conference on Superconductivity, sponsored by the Superconductivity Programme Management Board and the Department of Science and Technology of the Government of India and supported by many other agencies, was held at Bangalore from 10 to 14 January 1990.

There were 41 plenary and invited talks during the Conference representing the state of the art. These were published as a book titled “International Conference on Superconductivity — ICSC” in 1990 by the World Scientific Publishing Company (WSPC), Singapore. In addition to these talks, there were 298 contributed papers and oral presentations in the following areas: preparation, characterization, electrical properties, magnetic properties, theory and applications. 189 of the 298 contributed papers and the invited talk by M Yu Kuprianov, which could not be included in the volume published by WSPC, have now been published as three massive special issues of the *Bulletin*.

The editors hope that the academic interaction initiated at the conference will continue and that these published papers will be found useful by the community.


These two issues are devoted to the contributions presented at the Workshop on Recent Advances in Modelling and Control of Stochastic Systems held at the Indian Institute of Science (IISc), Bangalore from 7 to 11 January 1991. The Workshop was jointly sponsored by the Jawaharlal Nehru Centre for Advanced Scientific Research, the Department of Computer Sciences and Automation of IISc and the Central Research Laboratories of Bharat Electronics Limited. It focussed on four core areas of stochastic modelling, which have seen tremendous activity in recent years, viz. Learning Automata and Neural Networks, Identification and Control of Stochastic Systems, Queueing Models for Performance Analysis of Computer and Communication Systems and Stochastic Models for Manufacturing Systems.

The prime motivation for organizing the Workshop was the feeling, later justified by events, that there are enough workers in the frontiers of these areas and even more persons interested in them to provide a “critical mass” and the hope that events like the Workshop could trigger heightened activity based on an exchange of ideas. All twelve of the papers presented at the Workshop are published in these two issues of *Sādhanā*.


The laser, as a radiation source, with its high intensity, sharp frequency and short pulse duration, has revolutionized chemistry in many diverse research areas such as molecular spectroscopy, molecular dynamics, linear and nonlinear photochemistry, photobiology, radiative and non-radiative molecular processes, dynamics of ultrafast processes and structure and dynamics of the liquid state. The present volume contains 38 invited and contributed talks presented at the Conference on Lasers in Chemistry held from 11–15 June 1990, at Miramare, Trieste, Italy by the newly formed International Centre for Pure and Applied Chemistry (ICPAC), established in Trieste jointly by the Third World Academy of Sciences, the UN Industrial Development Organization (UNIDO) and the Italian Government, which forms part of the International Centre for Science and High Technology (ICS).

The volume contains first the contributions from invited speakers, followed by contributed articles arranged and grouped by fields.
A discussion meeting on Computer Format Analysis of the People of India Project jointly organized by the Academy, the Anthropological Survey of India and the Centre for Ecological Sciences, was held at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore from July 12–16, 1991. About 23 scholars took part in the deliberations.

The People of India project was initiated by the Anthropological Survey of India on 2 October 1985 to obtain a brief anthropological profile of various communities of India. In this project 4410 different communities were identified and studied, covering all the States and Union Territories. Each community was studied in one or two locations, interviewing at least five key informants, of whom one was a woman. Two hundred and sixty six research personnel from the Anthropological Survey of India and 215 scholars from various universities and research institutes were involved in the project who on the whole spent 22442 days in the field, interviewing 23862 people, covering 2908 villages and 2359 towns and cities. A seventeen point schedule guideline was used to collect data on various aspects like synonyms, subgroups, titles, language, distribution, population, natural environment, food habitat, life-cycle rituals, economic activities, art, craft, religion, social organization, intercommunity linkages, attitude towards developmental programmes, and so on. Based on data collected in the field, a report of about 3000 words and an abstract of about 300 words were prepared. In addition to this a computer format, which lists 730 ethnographic traits, was prepared. Two volumes on Scheduled Castes and Scheduled Tribes, and three volumes on all communities were printed and a two-volume annexure, listing communities, language tables, lists of synonyms, surnames, subgroups, titles, clans etc. Volumes on each State/Union Territory are under preparation. A preliminary analysis of the computer format was made and the results were used to indicate broad trends. It was then decided to undertake an in-depth analysis of the computer format in collaboration with the Centre for Ecological Sciences, Indian Institute of Science, Bangalore.

K S Singh, Director General, Anthropological Survey of India, New Delhi opened the discussion with a talk on the genesis and background of the project “People of India”.

Madhav Gadgil next spoke on how best the People of India data can be fruitfully utilized from various angles. He highlighted the resource subsistence management in small scale societies and complex societies and how the interplay of ecological and occupational factors effect in several societies can be studied.

Several useful guidelines for further work emerged from the extensive discussions. It was felt that the methodology employed for deciding the kind of data to be collected, and for collecting field data, should be described in a detailed document. A more selective approach should be taken in the choice of traits to be analysed and controversial items like bonded labour should be dropped. The richness of the data is such that simple univariate analysis is bound to give very important insights, and should be completed before more complex multivariate analysis is taken up.

One of the most useful outcomes of the meeting was the identification of some important and hitherto undocumented traits, such as pastoral/non-pastoral, nomadic, urban/rural etc. Tabulation of these traits is to be taken up on a priority basis.

After the trait-wise analysis, the analysis of communities, separately for distinct groups such as scheduled castes, scheduled tribes, minorities, varna categories, artisan group, fishing communities etc. would be taken up.

In the next phase of analysis, clustering of traits, clustering of communities and exploration of variations at state and regional level would be taken up. To this end, it was suggested that preliminary maps depicting the distribution of traits may be prepared.

A second round of discussion was held in October 1991 at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore and a National Seminar on the Project is to be held in January 1992 at New Delhi.
Obituaries

**John Stuart Anderson** was born in London on 9 January 1908. He was educated at Acton Technical College and the Imperial College of Science, London where he took his doctorate degree in chemistry in 1931. He worked for a year at the University of Heidelberg under Prof. Walter Hieber as post-doctoral Fellow and later as demonstrator/assistant lecturer at the Imperial College from 1932–1938. He moved to Australia in 1938, accepting a post in the University of Melbourne as a senior lecturer in inorganic chemistry. There he embarked on the research that was to establish him as a leading solid state chemist and formulated the theme that permeated the rest of his life. He returned to Britain to become Head of the Chemistry Division of the British Atomic Research Establishment at Harwell, where he shaped the programme of pure and applied inorganic chemical research and initiated work in high temperature chemistry and chemistry of radioactive elements. His studies on uranium compounds were and remain classics of their type.

He returned to Australia in 1954 for 5 years to head the Department of Chemistry of the University of Melbourne. He returned to London in 1959 to become Director of the National Chemical Laboratory, Teddington, and after four years moved to Oxford as Professor of inorganic chemistry, remaining there until his retirement in 1975, when he moved to the University College of Wales, Aberystwyth, where he spent six years in the Department of Chemistry as honorary Professorial Fellow. His final move was to the Australia he loved, to the Australian National University, Canberra, where he joined the Solid State Chemistry group associated with Prof. B G Hyde. He continued with active research in the laboratory until his final illness. He passed away on 25 December 1990 at Canberra.

His great contributions were in the field of solid state chemistry. In the early years of the century, chemistry was largely a molecular science and it was generally taken as irrefutable that chemical compounds, solid or not, had fixed stoichiometric compositions. Anderson broke down this rigidity in a number of classical investigations on solids, which had variable composition, now called non-stoichiometric compounds.

His earlier studies pioneered the application of thermodynamic and statistical mechanical analysis to these materials. In the mid-sixties, recognising that the application of high resolution electron microscopy could directly reveal the structures of non-stoichiometric compounds, which could not be solved by other means, he carried out a series of beautiful studies that to this day remains unsurpassed. This unique combination of thermodynamic and structural viewpoints allowed him to weld an emerging and fragmented subject into a coherent science.

His many contributions to chemistry earned him numerous honours during his career. He was elected a Fellow of the Royal Society in 1953 and was awarded its Davy Medal in 1973. He was elected an Honorary Fellow of the Academy in 1978.

**Ranchodji Dajibhai Desai** passed away in the early hours of Saturday, 16 November 1991.

Born on 4 May 1897 in Umarsadi in South Gujarat, he had his formal school education at Bai Avabai High School, Valsad, obtaining a high rank at the Matriculation Examination of 1916; he continued his studies at the Wilson College, Bombay, and the Indian Institute of Science, Bangalore, where he obtained the M.Sc. Degree in chemistry in 1926, winning the R R Desai Gold Medal of Bombay University. He taught for a while at the Wilson College, Bombay, and at M.S. University, Baroda, before proceeding to London for higher studies as Sir Mangaldas Nathubhai Research Scholar.

In 1928 he joined the Imperial College of Science and Technology, London, under late Dr J F Thorpe, FRS, and obtained the D.Sc. degree of the University of London in chemistry in 1931.

On his return to India he taught chemistry at the Aligarh Muslim University and served as Professor of Dyestuff Technology in the University Department of Chemical Technology, Bombay, and as Principal of the L.D. Arts College and M.G. Science Institute, Ahmedabad. During his career as a teacher and research scientist for over four decades, he was active in many fields in organic chemistry like (a) the strainless character of alkylcyclopentane and alkylcyclohexane rings on the basis of thermodynamic and statistical viewpoints, (b) studies in valency deflexion hypothesis, (c) jautomerism of heterotriads, (d) new methods for the synthesis
Govind Pandurang Kane was born on 2 March 1911 in Dapoli in the Ratnagiri District of Maharashtra. He had his early education in Bombay where his father was a practising lawyer. He had his higher education at the Royal Institute of Science and at the St. Xavier's College, Bombay, from where he obtained his B.Sc. degree in chemistry and geology in 1931, passing with first class honours and distinction. He obtained the M.Sc. degree at the University of Bombay in 1934 for his research work in the Department of General and Physical Chemistry at the Indian Institute of Science winning the Sudborough Medal.

Learning of the exciting research investigations on combustion by W A Bone and his colleagues at the High Pressure Research Laboratory of the Imperial College in London, he applied for and was admitted for research under the guidance of Prof. Bone. He obtained the Ph.D. degree of the University of London and the D.I.C. of the Imperial College in 1936, with research on the spontaneous ignition under pressure of the simpler olefins in admixture with air.

He joined as Reader at the Chemical Engineering Department in Bombay University in May 1939 and became a Professor in the same Department ten years later. In 1946 he was promoted as the Director of the Department of Chemical Technology for a brief period. The reorganization of training, and the expansion of the Chemical Engineering Section when the Department moved into its own building at Matunga in 1943, kept him busy for the first few years. Later, in association with the late Dr H L Roy, he took a prominent part in reorienting chemical engineering training throughout the country. For research, he chose topics that had a bearing on industry, irrespective of whether the work would provide material for the publication of papers in scientific journals.

He established a lasting link between the chemical industry and the university in many ways. Eminent chemical engineers from industry were invited as external examiners for the first degree examination in chemical engineering, as well as for theses submitted for post-graduate degrees and to give a series of lectures to students on subjects of their specialization. He visited various factories on request and advised them as a consultant. In 1954 he joined the Development Wing as Industrial Adviser (Chemicals) under the Ministry of Commerce and Industry. He was promoted as Senior Industrial Adviser (Chemicals) in 1957 and Deputy Director General (Chemicals) in 1963. From 1965 until his retirement in March 1969, he served with distinction as Officer on Special Duty in the Ministry of Industrial Development. During all these years he played a conspicuous part in the integrated development of chemical and engineering industries that helped the country to achieve self-sufficiency with respect to many products and paved the way for an export drive for non-traditional items.

He served as Chairman of various committees on alcohol, petrochemicals, fertilizers, coke-oven by-products and vegetable oils. After retirement he worked as a Visiting Professor at the University of Pittsburgh (USA) for a year.

He was elected a Fellow of the Academy in 1943. He was a founder member and President of the Indian Institute of Chemical Engineers, a Fellow of the Institute of Chemical Engineers, London and its Vice-President; and a Fellow of the Institute of Fuels, London. He continued to be active after retirement, as a technical and industrial consultant, and as a Chairman/Director of several companies.

The foundations he laid for the chemical industry in the course of his association with national planning during the second, third and fourth five-year plans stand as monuments to his vision and sagacity.

He passed away on 25 June 1991 at Bombay.
Shankar Lal was born on June 25, 1923 in Banaras, where he had his early education. He had his higher education at the Banaras Hindu University where he obtained in 1941 his B.Sc. degree in engineering with first class honours and at the Indian Institute of Science, Bangalore, and the Imperial College of Science, London, where he obtained Diplomas in Aerodynamics, an M.Sc. degree in engineering from the London University in 1949 and the Ph.D. degree from the California Institute of Technology in 1955. He was lecturer and Assistant Professor of Mechanical Engineering at the Banaras Hindu University from 1950–1958 and Professor of Mechanical Engineering at the Roorkee University from 1958–1978. He was the Director of the Indian Institute of Technology, Kharagpur from 1978–1983. After his retirement in 1983, he served as Adjunct Professor, Mechanical Engineering Department, at the Naval Post-graduate School at Monterey, USA. He passed away at Monterey on 25 September 1991.

He was elected a Fellow of the Academy in 1974. His scientific contributions were in the fields of fluid mechanics, heat transfer and solid mechanics.

Polapragada Bhaskara Rama Murti was born on 11 November 1911 at Kaikavolu in East Godavari District of Andhra Pradesh. He had his higher education at Andhra University where he took his B.Sc. (Hons.) degree in Chemical Technology and M.Sc. and D.Sc. degrees in chemistry. He joined the J.V.D. College of Science and Technology in 1936 and worked there till 1942, when he joined the Board of Scientific and Industrial Research, Delhi, as research chemist. From 1944, he served as Tinctorial Chemist to the Government of Madras (1944–1947); Principal, Government Polytechnic (1947–1963); Professor of Chemistry, College of Engineering, Kakinada (1967–1969).

His main contributions were in plant chemistry, waxes, resins, dyestuffs and triterpenes. He was elected a Fellow of the Academy in 1944 and a Fellow of the Royal Institute of Chemistry, London, in 1946. He passed away in December 1990.

Chandrasekhar Ramaswamy was born on 20 August 1907. He was educated at Calcutta and Madras and took his BA (Hons.) degree in Physics from the University of Madras in 1928, obtaining his titular MA two years later. After a brief period of research as a University Scholar, he joined the India Meteorological Department, as an Assistant Meteorologist in 1931.

In 1954, Prof. Carl G Rossby invited Sri Ramaswamy to participate in the research activities at the Institute of Meteorology, Stockholm. His work at Stockholm during that year was on the sub-tropical jet stream discovered during World War II.

On being elevated to the position of a Director in 1956, that of a Deputy Director General in 1959, and finally that of the Director General in 1965, his administrative responsibilities became very heavy. In spite of these, he continued his work on the interaction between tropical and extra-tropical weather systems. It was due to his persistent efforts that an international meteorological radio teletype was established between Delhi and Melbourne in 1966.

Ramaswamy’s researches were mostly on the various aspects of the Indian Monsoon, regional and global. His last contribution, published in 1987, when he was 80, is a large Monograph “Meteorological Aspects of Severe Floods in India, 1923–1979” which deals with the different synoptic weather situations which caused the severe floods, the rainfall amounts associated with each flood, and the effects of those floods on the people as could be gathered from official and newspaper reports.

After relinquishing his post as the Director General of the India Meteorological Department he registered as a post-graduate student, at the age of 60, and obtained a Doctor’s Degree a few years later. He continued to do scientific work with financial assistance from the Council of Scientific and Industrial Research (CSIR). Jointly or singly he published 22 scientific papers after his retirement from Government Service, his last publication being in 1987.

Sincerity, devotion to duty, a sense of justice and humility were some of the noble personal qualities of Dr C Ramaswamy. He was elected a Fellow of the Academy in 1938. He passed away at Anand, Gujarat on 17 August 1991.

He is survived by his wife and three sons.
Pradip Ranjan Roy passed away on April 21, 1991 at Bombay. An internationally known metallurgist and a pioneer in the field of nuclear metallurgy, particularly plutonium metallurgy, he was at the time of his death Director, Materials Group, Bhabha Atomic Research Centre, Bombay.

Born in 1936, he had a brilliant academic career, graduating with distinction in Metallurgical Engineering from Bengal Engineering College, University of Calcutta. He joined the Atomic Energy Establishment, Trombay in 1958 and immediately got involved in the metallurgical research and development on plutonium. Plutonium, not present in nature, is produced only in an operating nuclear reactor. It is highly radioactive and calls for complicated handling techniques, with highly shielded and well-contained operations. Mass criticality is another dimension that one has to reckon with at every stage of its production, processing and use. It was due to his unwavering determination and brilliance that he and his colleagues were able to achieve what they did in plutonium metallurgy and plutonium bearing fuel fabrication.

Among his various achievements in both basic and applied plutonium metallurgy, development of mixed uranium-plutonium oxide fuel, popularly known as MOX fuel as an alternative to enriched uranium oxide fuel for use in Tarapore Atomic Power Station and of mixed uranium-plutonium carbide fuel for the Fast Breeder Test Reactor at Kalpakkam are outstanding contributions to the atomic energy programme. A mention must also be made to his equally important involvement in the design of the plutonium device for the peaceful nuclear explosion experiment carried out at Pokhran. He was also deeply involved in the development of powder metallurgy in general and of nuclear metals in particular in the country.

He was elected a Fellow of the Academy in 1983. He received the National Metallurgists’ Day Award and the Padma Shri in 1975 for his contributions to the peaceful nuclear explosion experiments, the Vasvivk award in 1985–86 for his contributions to Materials Science and Technology and the Om Prakash Bhasin Foundation Award for energy in 1988. He served as Vice-President and President of the Powder Metallurgy Association of India.

His death at the early age of 55 is deeply mourned by a large circle of his friends, colleagues and admirers.
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