

1 INTRODUCTION

The Academy was founded in 1934 by C.V. Raman with the main objective of promoting the progress and upholding the cause of science (both pure and applied). It was registered as a Society under the Societies Registration Act on 24 April 1934.

It commenced functioning with 65 fellows. Its formal inauguration took place on 31 July 1934 at the Indian Institute of Science, Bangalore. On the afternoon of that day its first general meeting of Fellows was held at which C.V. Raman was elected its President and the draft constitution of the Academy was approved and adopted. The first issue of its proceedings was published in July 1934.

The present report covering the period April 2002 to March 2003 represents the sixty-ninth year of the Academy since its founding.

2 THE FELLOWSHIP

2.1 2002 elections

A total of 372 nominations received for fellowship in different disciplines were considered first by the eight sectional committees and later by the council. Following postal balloting, 24 new fellows were elected, the fellowship effective from 1 January 2003. A list of their names follows while Annexure 1 gives their particulars. Also elected were two new Honorary Fellows.

Fellows:

- | | |
|---------------------------|---------------------------|
| 1. Bhattacharya, Dipankar | 2. Biswas, Indranil |
| 3. Chakraborty, Tushar K | 4. Chandrasekhar, V |
| 5. Chaudhuri, Probal | 6. Das, Pijush K |
| 7. Gavai, Rajiv V | 8. Jayaram, Vikram |
| 9. Kaul, Sharika N | 10. Krupanidhi, S B |
| 11. Mahadevan, S | 12. Mande, Shekhar C |
| 13. Misra, U K | 14. Nagaraju, J |
| 15. Pitchappan, R | 16. Prasad, G V R |
| 17. Purnachandra Rao, V | 18. Reddy, A. Ramachandra |
| 19. Sahni, Varun | 20. Samanta, Anunay |
| 21. Shah, Nimish A | 22. Sharma, Shobhona |
| 23. Sinha, Subrata | 24. Venkateswara Rao, G |

Honorary Fellows:

- | | |
|-----------------------|---------------------|
| 1. Dodson, George Guy | 2. Sreenivasan, K R |
|-----------------------|---------------------|

2.2. In memoriam

The Academy regrets to report the death of the following twelve fellows and two honorary fellows during the period up to March 2003. Annexure 2 gives additional information about them.

Fellows:

- | | |
|-------------------|--------------------|
| 1. Anil Kumar | 2. Kapur, J N |
| 3. Khoshoo, T N | 4. Lal, M B |
| 5. Menon, K K G | 6. Narasimham, N A |
| 7. Patel, A R | 8. Pisharoty, P R |
| 9. Pradhan, S K | 10. Puri, V |
| 11. Saldanha, C J | 12. Sen-Sarma, P K |

Honorary Fellows:

- | | |
|--------------------|-----------------|
| 1. Caspersson, T O | 2. Porter, Lord |
|--------------------|-----------------|

2.3 Strength of the fellowship

	Fellows	Honorary Fellows
1 April 2002	832	44
Elected (December 2002)	24	2
Deceased (2002 - 2003)	12	2
1 April 2003	844	44

2.4 Fellowship analysis

Continuing with our analysis of the fellowship, this year, we deal with the the fellowship of the three national academies – the Indian Academy of Sciences (IAS), Bangalore, the Indian National Science Academy (INSA), New Delhi, and the National Academy of Sciences (NAS), Allahabad. According to the latest year books, the strengths of the fellowship were:

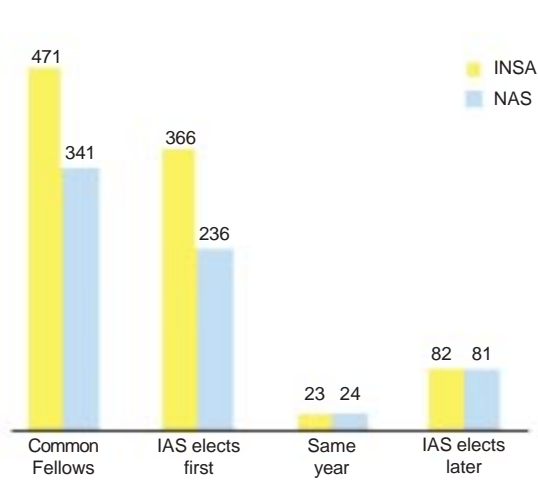
IAS – 845, INSA – 728, NAS – 1106

making a total of 2679 names.

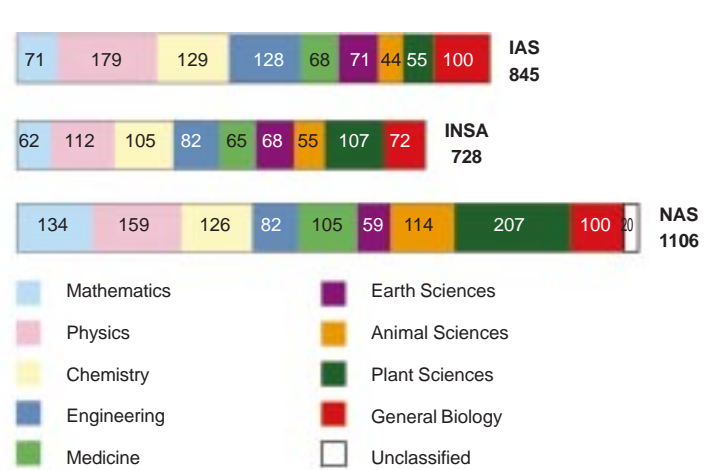
The following charts give data about the Fellows common among the three Academies, who elects when, and subject-wise break-up of the fellowship.



Fellowship strengths and Fellows common among the three Academies



Elected details of Fellows common between IAS and the other two Academies



Subject-wise break-up of fellowship of the three Academies

3 COUNCIL

Two statutory meetings of the council were held in Bangalore on 6 July and 30 November / 1 December 2002.

4 ASSOCIATES

Twenty-four nominations were received, of which, the following five were selected as Associates in 2002 (see also Annexure 3). The selections continue to be restricted to those below the age of 32 and the tenure ceases after five years or after the Associates attain the age of 35 whichever is earlier.

1. Athreya, Siva R
2. Holla, Yogish I
3. Padiath, Quasar S
4. Ranganathan, Anand
5. Shalivahan

5 PUBLICATIONS

5.1 Journals

Publications continue to be the major activity of the Academy and the eleven journals have appeared on their due dates. Tables 1 and 2 give the relevant particulars of the eleven journals while Table 3 gives the journal circulation figures for the year 2002.

5.2 Special issues of journals

Several journals brought out special issues on chosen topics as part of their regular numbers. A description of these follows:

(a) Formal verification of circuits and systems

Guest Editor: P. P. Chakrabarti

Sadhana, Vol. 27, No. 2, April 2002, pp 127–250

The problem of validation and verification of correctness of present-day hardware and software systems has become extremely complex due to the enormous growth in size of the designs. Today typically 50–70% of the design cycle time is spent in verifying correctness. While simulation remains a predominant form of validation, exhaustive simulation is rapidly becoming infeasible. There is now a wider recognition of the need to include formal methods in the task of verification. Today formal verification is finding increasing acceptance in some areas, especially model

abstraction and functional verification. Other major challenges, like timing verification, remain before this technology can be posed as a complete alternative to simulation. This special volume is devoted to presenting some of the different approaches that are major research issues in formal verification research today. The four articles present different flavours in the approach to formal methods in verification — algorithmic approach to timing analysis, algorithmic and logic-based model checking style of verification, an automata-theoretic approach to analysing timing properties of systems, and the assumption commitment method, a popular method to handle complexity of verification. While these do not cover all approaches being investigated today, they provide four important directions in verification search.

(b) Multi-colour universe

Guest Editors: R.K. Manchanda and B. Paul

Journal of Astrophysics and Astronomy, Vol. 23, Nos 1/2, March/June 2002, pp. 1–172

X-ray astronomy has seen many revolutionary trends since the discovery of the first X-ray source in 1962. Starting as a part of cosmic ray research with the early experiments using rockets and balloons, it has acquired a leading place in mainstream astronomy and astrophysics. The first path-breaking event took place in 1970 with the launch of the UHURU satellite. The first technological breakthrough came with the launch of the Einstein satellite in 1978, which for the first time employed the principle of focusing optics in the low energy X-ray region. The X-ray sky today is dotted with sources, which are 17 magnitudes fainter than ScoX-1, the first discovered source. A wealth of observational data has been produced on the entire ensemble of visible and invisible universe. However we are no closer to a complete understanding of the complexities of temporal and spectral properties of the large variety of X-ray sources. Due to limitations of the available technology of detecting high-energy photons, the energy band above 20 keV is still poorly explored. The most recent trend in the efforts to unlock the mysteries of our universe is the ‘multi-wavelength’ approach, which can give a more complete picture of the X-ray sources and emission mechanisms.

Experimental work in X-ray astronomy at TIFR started in 1966, using balloon-borne instruments in the energy band of 20–100 keV region. Rocket-borne soft X-ray surveys (0.15–2 keV) were conducted during 1972–1982. An all sky monitor to detect transient sources and study the time variability of steady X-ray sources in the energy range 2–20 keV was fabricated and launched on board the second Indian satellite *Bhaskara* in 1979.

It seemed an appropriate time to hold an international symposium to take stock of the recent developments in X-ray astronomy with particular emphasis on multi-wavelength observations. The four day symposium entitled ‘Multi-colour Universe’ was held during September 11–14, 2001 at TIFR, Mumbai to gain an understanding of the enormity of the discipline and the emerging priorities for coming decades. The symposium consisted of invited reviews, contributed talks and poster sessions.

This special volume contains a selection of 28 papers presented at the symposium in three broad categories: the Galactic sources (black hole and neutron star X-ray binaries, CVs, SNRs and stars), the extragalactic X-ray sources (Galaxies, AGNs, quasars, X-ray background and clusters of galaxies) and new technologies and future missions.



(c) Superconductivity and magnetism: Materials, mechanisms and devices

Guest Editors: R. Pinto, R. Nagarajan and A. K. Grover

Pramana, Vol. 58, Nos 5/6, May/June 2002, pp 715–1206

The phenomena of superconductivity and magnetism have remained at the centre stage of condensed matter science over the entire twentieth century. Once considered mutually exclusive, the two phenomena are seen to coexist and the interplay between them forms one of the most exciting aspects of present-day research in condensed matter physics and materials science. The discovery of superconductivity above the boiling point of liquid nitrogen in cuprates, colossal magnetoresistance in manganites, superconductivity and its coexistence with magnetic order in ternary alloys, quaternary borocarbides and boronitrides, superconductivity in fullerenes, etc. have all provided such an impetus to the field of superconductivity and magnetism since 1986 that the physics, chemistry, materials and devices aspects have become inseparable in the strongly correlated electron systems.

An international symposium held in Mangalore in September 2001 focused on some of the contemporary aspects of the above two phenomena. This special volume contains eighty of the contributions presented at the symposium divided into the following areas: strongly correlated electron systems, superconductivity, physics of vortex state, colossal magnetoresistance and other materials, and finally thin films and devices.



(d) Conservation of biodiversity – the new consensus

Guest Editor: Sahotra Sarkar

Journal of Biosciences, Supplement 2, Vol. 27, No. 4, July 2002, pp 299-435

When conservation biology emerged as an identifiable organized discipline in the late 1980s it was already apparent that it would have to draw its principles and practices from many different biological specialties including genetics, evolution and, especially, ecology. However, besides this single point of agreement, the practice of conservation biology diverged radically in different cultural and political contexts. In the North, particularly in the United States, humans were perceived as being essentially separated from nature, and their presence was taken to be the main reason for biodiversity depletion; human exclusion and wilderness preservation became major tenets of the new discipline. For many of these conservation biologists, the discipline's normative foundations were provided by "deep ecology", a doctrine of questionable intellectual cogency and considerable ethical dubiety. In sharp contrast, in the South, particularly in India and Latin America, biological conservation was viewed to be so closely integrated to cultural traditions in which the conservation of biodiversity was seen as part of the biocultural restoration of degraded habitats and the preservation of cultural practices that co-evolved in harmony with biodiversity. Over the years this view has been called human, liberation, or social ecology.

If in the North, in the United States, for instance, the pursuit of a science of biodiversity conservation was largely seen in continuity with basic rather than applied biological science, in the South, it was usually perceived to be in continuity with the social sciences. During the last five years,

however, a synthetic consensus framework of conservation planning has emerged. Insights from each of the different traditions and insights gained from experience in the field during the last few decades have been integrated in this framework.

The papers collected in this supplement reflect the new consensus framework of conservation biology and illustrate each of its aspects from different points of view. An effort has been made to include exemplars of all the major research programmes in conservation biology.

Several of the papers published here were presented at a workshop “Philosophical issues in biodiversity conservation”, held at the University of Texas in Austin (USA) under the auspices of UT’s Program in the History and Philosophy of Science.

(e) Fracture mechanics of concrete

Guest Editor: B.K. Raghun Prasad

Sadhana, Vol. 27, No.4, August 2002, pp. 411–492

Fracture mechanics of concrete is generally considered the third phase in the evolution of concrete structures. Kaplan in 1961 tried to obtain the fracture toughness of concrete. It was later observed that there was no consistent value of fracture toughness of concrete. Towards early eighties, nonlinear fracture theories were proposed. The process zone ahead of the crack tip was identified as having an important role to play in the nonlinear fracture mechanics of concrete. A little later, it led to the size effect. Various meetings subsequently discussed the developments in this field.

In recent years, as high performance concrete is gaining importance, its fracture behaviour is being studied with great seriousness. High strength concrete is nearer to linear theories of fracture and is relatively more brittle. The challenge is whether one can make high strength concrete relatively more ductile by improving the cohesiveness of cracks. The next question is how to bring the size effect into codes of practice on the design of reinforced concrete structures, since large structures like dams, nuclear reactors, and very tall towers, do contain large sized members.

This special issue attempts to address the question whether it is correct to assume the same tensile strength as obtained in the laboratory for full-scale structures as well. The six articles on concrete cover work on crack formation and fracture energy, embrittlement and apparent strength, cohesive stresses, size effect and its application to compressive strength, and finally ATENA, a software for nonlinear fracture.



(f) Foundation of Quantum theory and quantum optics

Guest Editor: Rupamanjari Ghosh

Pramana, Vol. 59, No.2, August 2002, pp 163–432

The papers put together in this volume were presented at the second Winter Institute on “Foundations of quantum theory and quantum optics” held at Kolkata in January 2002. The scope of the Winter Institute was quite broad and its aim was to play a proactive role in seeding and sustaining research collaborations in the emerging area of quantum mechanics, quantum optics and mesoscopic physics. The 34 papers included in the volume cover topics involving quantum entanglement and nonlocality, quantum tunneling, quantum

teleportation, quantum computation, measurement and decoherence, stochastic quantum mechanics, formulation of a maximally classical and realistic quantum theory, fundamental light-matter interactions, etc.

(g) Modern trends in inorganic chemistry

Guest Editor: P. Banerjee

Proceedings: Chemical Sciences, Vol. 114, No.4, August. 2002, pp. 231–460

This special issue of the Proceedings is based on 19 papers presented at the Ninth Symposium on “Modern trends in inorganic chemistry” (MTIC-IX) held in December 2001 at the Indian Association for the Cultivation of Science, Kolkata. The topics covered in MTIC-IX span a wide range in keeping with the current trends of research in inorganic chemistry.

(h) Pacific ocean remote sensing conference

Guest Editors: E.Desai, R. Brown, S. Shenoi and George Joseph

Proceedings: Earth and Planetary Sciences, Vol. 111, No.3, Sept.. 2002, pp. 187–378

The Pan Ocean Remote Sensing Conference (PORSEC) was formed in 1992 to provide a venue for international cooperation in the increasingly important area of remote sensing of the ocean. Many countries that border the southern and tropical ocean are experiencing rapid “development”, the impact of which is significant on the oceans though difficult to quantify. PORSEC aims at providing a common platform for scientists to discuss innovative applications for the newly available global satellite data sets. This is expected to lead to cooperation in studying ocean-related topics as diverse as air-sea interaction, fisheries, and pollution. Through this cooperation, holders of satellite data hopefully meet and interact with holders of sea-truth data to their mutual benefit.

Since its formation, PORSEC has met in Okinawa, Melbourne, Victoria and Qingdao. The fifth meeting at Goa was held during December 2000, at which 262 participants from 31 countries attended. A substantial two-volume proceedings (900 pages) containing 197 papers was published during the conference. The present volume is a compilation of seventeen selected papers from the conference. The papers are evenly divided between applications of ocean colour, wind and ocean dynamics, and modelling with satellite sensor (mainly microwave) data. Some of the presentations are of regional interest, while others will find an audience beyond the satellite remote sensing community. These first results through their simple presentation of observations and hypothesis could well contain the seeds of breakthrough science.



(i) The biology of *Entamoeba histolytica*

Guest Editor: Anuradha Lohia

Journal of Biosciences, Vol. 27, No.6, Nov. 2002, pp. 553–628

Protozoan parasites, especially the ones that cause disease, are of tremendous interest to biologists. The reason is that these ‘lower eukaryotes’ are able to successfully encroach, occupy and not only live off a ‘higher eukaryote’, they also cause terrible misery to their

unknowing hosts. One such human pathogen, *Entamoeba histolytica*, forms the subject matter of this special issue.

These unicellular organisms were referred to as ‘primitive eukaryotes’ in textbooks and journals alike, since they (supposedly) lacked ‘typical eukaryotic subcellular organelles’. It was commonly believed that they were ancestral to higher eukaryotes which appeared later in evolution. They were also thought to divide by a process of asexual reproduction called ‘amitosis’ which was not seen in eukaryotes. In the last 15 years, molecular biology has eradicated many of these myths and established that parasitic protozoa are not primitive — but are actually very complex, often exhibiting ‘atypical’ characteristics when compared to other eukaryotes.

In addition to a review of the evolution of eukaryotic diversity and an article on genetic diversity this special issue also brings together key articles on adhesion, signalling, differentiation, cytopathic molecules, and cell cycle of amoeba.

(j) **Frontiers in materials science and technology**

Guest Editors: S.Basu and P.Bhargava

Bulletin of Materials Science, Vol. 25, No.6, Nov. 2002, pp. 449–582

As part of the golden jubilee celebrations of IIT, Kharagpur, a national conference on “Frontiers in materials science and technology” was held in February 2002. Electronic materials, ceramics, polymers and composites formed the subject matter of the conference. The papers presented included critical reviews and experimental results of strategic materials used in defence, medical and consumer sectors and on the current development of materials including nanomaterials, nanostructures, smart materials and MEMS.

This special issue contains 32 articles presented at the conference from across the country.



(k) **Heavy ion accelerator technology**

Guest Editors: A. Roy, S.K. Datta, M.B. Kurup and S. Kailas

Pramana, Vol. 59, Nos. 5/6, Nov./Dec. 2002, pp. 703–1098

The ninth international conference on “Heavy-ion accelerator technology” was held in New Delhi during January 2002. The topics covered were: Electrostatic accelerators, booster accelerators, superconducting structures, RFQs, acceleration of radioactive ion beams, accelerator mass spectroscopy, ion sources, heavy ion injectors, and cryogenics for boosters. The presentations covered the operational experiences of existing accelerator facilities, the progress in the implementation of approved projects and the direction of advancement of future heavy ion accelerator systems.

The papers presented were brought out as two issues of *Pramana*. The forty contributions were divided among the following topics: electrostatic accelerators, ion sources, LINAC and boosters, radioactive ion beams, future accelerator, radio frequency quadrupoles, beam transport/beam dynamics/control system/electronics, and accelerator mass spectrometry.

(l) Recent advances in photochemistry

Guest Editors: J. P. Mittal, Tulsi Mukherjee and A. V. Sapre

Proceedings: Chemical Sciences, Vol. 114, No.6, Dec. 2002, pp. 521–792

Photochemistry is considered a thrust area of research activity worldwide. To bring together various researchers and students working in Asian countries, Asian Photochemistry Conferences (APC) have been held since 1997 in Hong Kong and Korea. The third was held in India at Mumbai in January 2002. Due to the complementary nature of radiation and photochemistry, the biennial Trombay Symposium on radiation and photochemistry (TSRP) was jointly held with APC.

This volume is a selection of 23 articles dealing with frontline and thrust areas of research in radiation and photochemistry.

(m) Computational materials science

Guest Editors: G.P. Das, V. Kumar, S. Ranganathan and U.V. Waghmare

Bulletin of Materials Science, Vol. 26, No.1, January 2003, pp. 1–205

Computational materials science (CMS) is rapidly emerging as a powerful multidisciplinary branch of science that contributes towards a better understanding of materials. There is a broad spectrum of length scales that describe different systems and phenomena right from nano- to micro- to meso- to macroscopic level. However, it is the interatomic interactions that hold the key for understanding the microscopic properties of materials. For electronic/atomistic simulations of solids, surfaces, interfaces and clusters, first-principles electronic structure and molecular dynamics calculations based on density functional theory are being extensively used. It is the accuracy, reliability and most importantly predictive power of these simulation tools that can be exploited in designing novel materials whose properties can be tailored to suit the desired application.

The initiative for Asian consortium for computational materials science (ACCMS) was undertaken to consolidate the rich human resources and expertise available in the Asian region, and to promote collaborative research amongst member countries in the field of CMS. The first conference was organized by the Materials Research Society of India in Bangalore during Nov-Dec. 2001. This international meeting brought together active researchers from various Asian countries, viz. Bangladesh, China, India, Iran, Japan, Korea, Singapore, Thailand and Vietnam. Some leading experts from Europe in the field of electronic structure were also invited to this meeting.

The conference witnessed excellent overviews of materials modelling and predictions of material properties using density functional tools. Several pioneers discussed the state-of-the-art electronic structure methodologies and also the multi-scale modelling which combines the information about atomic-scale processes obtained from DFT with techniques suitable to treat longer length scales. Oxides, perovskites, borides, different alloys, clusters and nanostructured materials formed the subject matter of the conference. This special issue contains 33 papers presented at the conference.



(n) Oxygen/nitrogen radicals: cell injury and disease

Guest Editors: V Vallyathan, R K Saxena and V Castranova

Journal of Biosciences, Vol. 28, No.1, February 2003, pp 1–134.

Reactive nitrogen and oxygen radicals have been known for long to play an important role in immune defence mechanisms. Over the last few decades, evidence has also been accumulating for a central role for these radicals in normal cellular functions. The Nobel Prize in Physiology and Medicine in 1998 was awarded to Robert F. Furchgott, Louis J Ignarro and Ferid Murad for identification of nitric oxide as a crucial signalling molecule in biological systems.

The idea of putting this issue together took shape during the Third International Conference on Oxygen/Nitrogen Radicals: Cell Injury and Disease, held in Morgantown, West Virginia, USA in June 2002. At this conference several diseases including Alzheimer's, atherosclerosis, arthritis, diabetes, Parkinson's disease as well as disorders of the eye, heart, skin and lungs were discussed. The conference also had special sessions on molecular mechanisms involved in disease development, the value of dietary supplementation with antioxidants in the prevention of cellular damage leading to chronic disease, therapeutic modulations of disease, special *in vivo* techniques and the role of molecular studies in human risk assessment. It provided a forum for over 240 experts, representing 21 countries and numerous state and federal regulatory agencies, to discuss and synthesize this information. A general consensus amongst the participants was that it would be useful to publish selected presentations, thereby providing a wider dissemination of the information presented during the conference.

The focus of this special issue is on our current understanding of the pathophysiological and molecular mechanisms of disease development. Dissemination of new advances in this emerging important discipline will enhance interaction and exchange of information between scientists and further their common goal of disease prevention and amelioration. This special issue contains 20 articles presented at the conference.



(o) High energy physics phenomenology

Guest Editors: B Mukhopadhyaya and Rohini M Godbole

Pramana, Vol. 60, No.2, February 2003, pp. 167–414

The seventh workshop on high-energy physics phenomenology (WHEPP-7) was organized at the Harish-Chandra Research Institute, Allahabad during January 2002. This special issue comprises most of the plenary talks delivered at the workshop together with several talks delivered at the four working groups and reports from the working groups on projects undertaken. Along the established tradition of the WHEPP series, the strongest emphasis in WHEPP-7 was on working group activities. A few focal themes were identified by each working group, which acted as the pivots for talks delivered and problems investigated. The group reports present only preliminary results of the investigations. The success of WHEPP since inception lies in forming a nuclei for new collaboration across India as well as on an international platform.