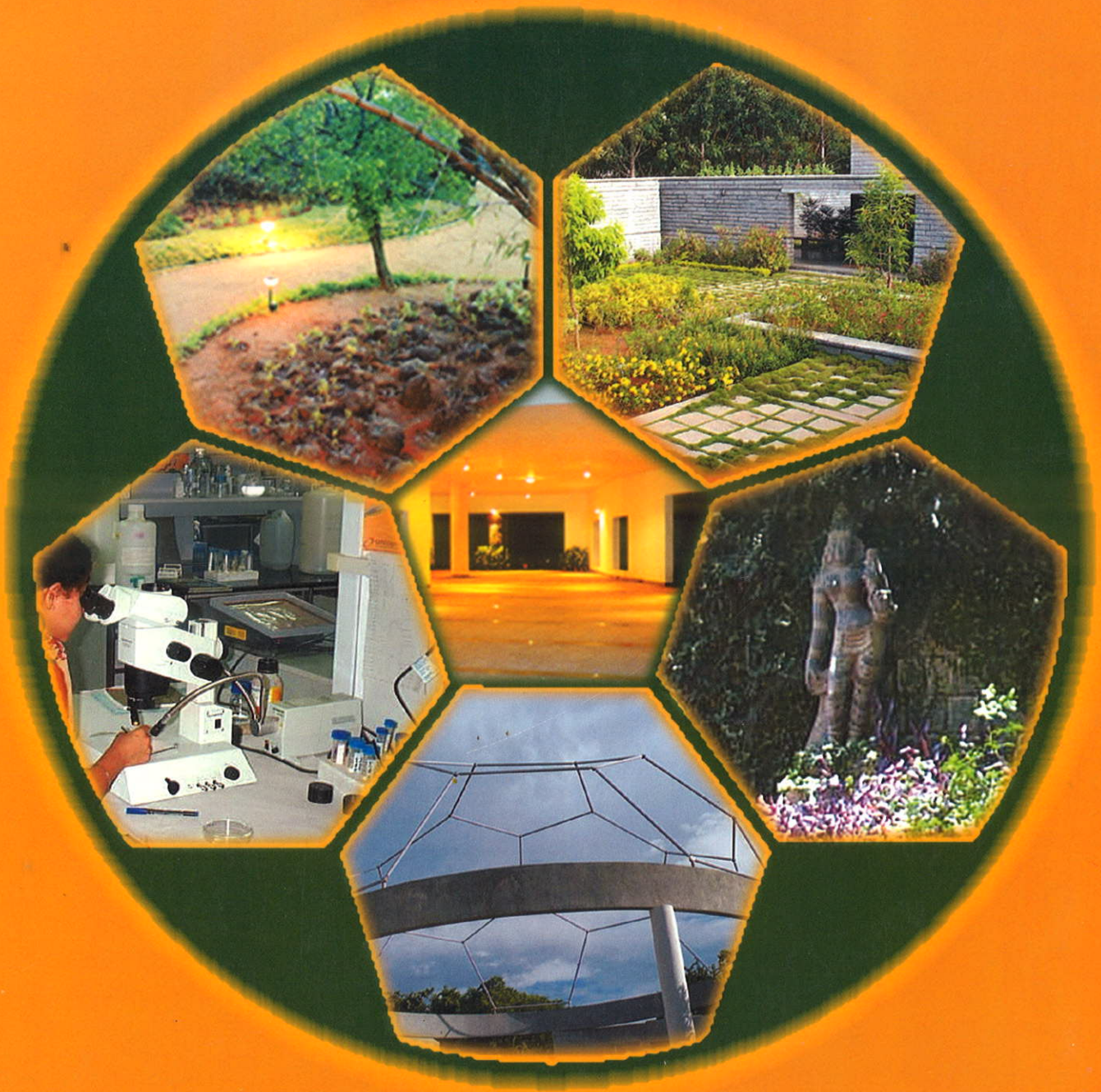
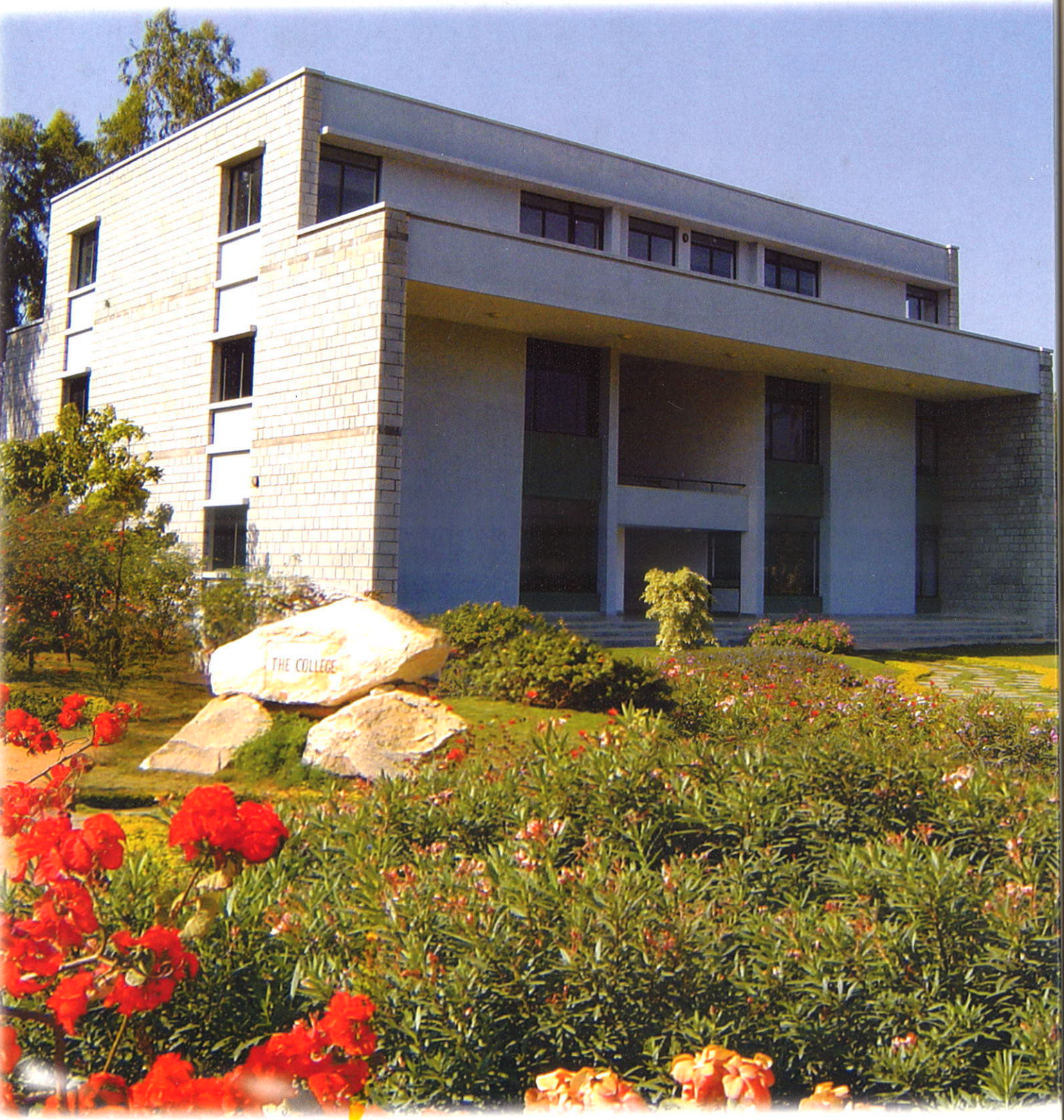
# JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

JAKKUR, BANGALORE - 560 064.



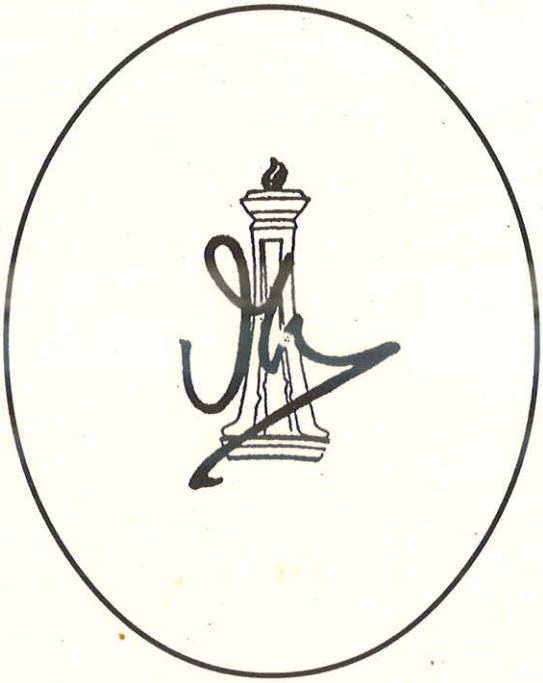
# ANNUAL REPORT

# 2003 ~ 2004


THE COLLEGE

# ANNUAL REPORT

## 2003-2004



## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

**(A Deemed University)**

Jakkur, Bangalore – 560 064.

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## Chapter V: Research Programmes



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# Chapter I

## THE CENTRE

### 1. FOREWORD

I have great pleasure in presenting the Annual Report of the Centre for the year 2003-2004.

The Centre has grown over the last decade, to become one of the leading institutions in the country for higher learning and research in frontier areas of science and engineering. Research activities in the areas of materials sciences, theoretical physics, molecular biology and genetics, evolutionary biology, chemical biology, geodynamics and engineering mechanics have continued to make significant progress. I am extremely happy to share that many of the contributions of our faculty colleagues and students have received both national and international recognition. Some of the research activities in material sciences and biology have yielded potential technologies that can be further developed by industrial partners. Considering our strength in teaching, training and research, the University Grants Commission has recognized the Centre as a Deemed University and this status allowed us to grow further in various academic activities. During this year 8 students have obtained Ph D degrees; 5 students of Ph D degree and 3 students of M S (Engg.) degree have completed all the academic formalities for the award of degrees. Two students have submitted theses for Ph D degrees. The number of students at the Centre has grown to 70 and it is envisaged that this will grow up to 100 in the next couple of years.

One of the very successful academic programmes of the Centre is the Summer Research Fellowship Programme for young students. During this year, 3917 completed applications were received, of which 150 students will be offered the fellowship to spend their summer in laboratories across the country. The students associated with this programme are highly appreciative of the unique opportunity provided to them and to get exposed to methods of research at an early stage of their career.

The new academic programme, Project Oriented Chemical Education (POCE) started to infuse creativity and scientific temper among the undergraduate students has received an overwhelming response.

The Honorary Faculty of the Centre are contributing significantly to the various academic and research programmes of the Centre and also towards training of young students under the Summer Research Fellowship Programme.

The excellent academic atmosphere and the ambience at the Centre is an ideal place for intellectual interaction and pursuit of knowledge which is the result of the fine work of students, the faculty, the honorary faculty and other members of the Centre. I take this opportunity to acknowledge the help that the Centre has received from its well wishers and friends and look forward for their continued support in the years to come. The continued support of the Department of Science and Technology is greatly appreciated.

**M R S RAO**
President

# 2. INTRODUCTION

The Jawaharlal Nehru Centre for Advanced Scientific Research was established in 1989 by the Department of Science and Technology, Government of India, to commemorate the birth centenary (1989) of Pandit Jawaharlal Nehru with the main objectives of promoting scientific research at the highest level in frontier and interdisciplinary areas of science and engineering. The Centre was registered as a Society under the Karnataka Societies Registration Act and is an autonomous national institution. The Centre was recognised as Deemed University by the University Grants Commission from August 2002.

The Centre has its main campus at Jakkur on the Bangalore - Hyderabad highway. The Centre maintains close academic collaboration with various national level research institutions and the infrastructural facilities available at the Centre are used by scientists of various institutions.

The beautiful campus amidst sylvan surroundings presently spans about 47 acres of which 33 acres was granted by the Government of Karnataka. The campus was dedicated to the nation in March 1995 by Shri K R Narayanan, the then Vice-President of India. A Students Hostel, some Faculty and Staff Housing are located on this Campus. At the IISc campus, the Centre has a Lecture Hall, Visitor's House (JAWAHAR) and Guest Rooms catering to the academic visitors to the Centre and the IISc. Various other facilities will come up shortly at the main campus.

The Centre has full-time faculty in the areas of its research activities and honorary faculty from all over India. Nearly 70 students are doing research towards regular Ph D, Integrated Ph D, M S and M S (Engg.) degree programmes.

The Council of Management of the Centre meets twice a year. The General Body meets annually. The Academic Advisory Committee of the Centre meets at least twice a year.

Prof C N R Rao, the founder of the Centre, held the office of President from 1989 to 1999. He is presently the Honorary President of the Centre. Prof V Krishnan, who succeeded him, served as President of the Centre from 2000 to 2003. Prof M R S Rao is presently the President of the Centre.

# 3. OBJECTIVES

The objectives of the Centre are:

- To carry out front-line research in selected thrust areas of science and engineering;
- To promote collaborative research with scientists at the Indian Institute of Science and other institutions in the country;
- To provide a national and international forum for in-depth discussions on important scientific topics in areas of vital interest to scientists of the Centre and in the country at large;
- To organize periodic winter and summer schools in certain areas, where young talented scholars would be associated;
- To provide opportunities for talented young students to carry out research projects;
- To provide facilities to visiting scholars and faculty from all over India and abroad, to work for extended periods with the faculty of the Centre;
- To publish monographs and reports on frontier and futuristic areas of science as well as monographs of educational value.

# 4. PROGRESS

The Centre has now completed fourteen years. It has acquired additional land in the recent past, built more laboratories with excellent infrastructure facilities conforming to the international standards. New Faculty appointments have been made in some research areas. The student strength has reached the projected level. The Centre has been recognised as a Deemed University by the University Grants Commission in August 2002.

The main campus at Jakkur houses The Chemistry and Physics of Materials Unit, Educational Technology Unit, Evolutionary and Organismal Biology Unit, Engineering Mechanics Unit, Geodynamics Unit, Molecular Biology and Genetics Unit, and Theoretical Sciences Unit. The Centre has a good quality Library, excellent Computer Laboratory, Lecture Halls, a Chemical Education Laboratory, a Conference Hall, a Seminar Hall, a Poster Presentation Hall, Faculty Offices and the Administrative Office.

The Chemical Biology Unit and the Condensed Matter Theory Unit are located on the IISc Campus. On this campus, the Centre also possesses an Administrative Office with a seminar hall, a well-furnished accommodation for the academic visitors and a Visitor House for the students and the R & D Assistants.

The Centre has acquired an additional land of 18.40 acres. Construction of a new hostel building has just begun. A sewage treatment plant is ready for operation. A new council room has become functional. The College is utilized for all the academic activities of the Centre. The construction work of a new biology laboratory will be completed soon. Internet connectivity has been upgraded from 1 mbps to 2 mbps bandwidth.

The Centre pursues excellence in research and education in frontier and interdisciplinary areas of science and engineering. It provides stimulating academic environment to the talented, motivated students to pursue scientific research. The students strength at present is about 70. To date, the research training at the Centre has led to the award of 14 Ph D degrees, 11 M S degrees and one M Sc (by research) degree.

Some of the recent research achievements (some await IPR) at the Centre include:

- Relationship between fragility, configuration entropy and the potential energy landscape of glass forming liquids;
- Polymer based photo-FET;
- Y-shaped Carbon nanotubes;
- Use of Hydroxydiphenyl Ether class of chemicals, as exemplified by Triclosan, as an antimalarial and identification of fatty acid synthesis as its target;

- Defective chemokine activity of the HIV-1 subtype-C Tat protein;
- Modulators (activators/inhibitors) of histone acetyltransferases;
- Tectonic activities shaping the spatial patchiness in the distribution of global biodiversity; and
- Polyisoprelylated benzophenones and their isomers as inhibitors of Histone acetyltransferases and other uses.

The Centre is actively pursuing interaction with academic institutions and universities globally. Honorary Faculty Members of the Centre have continued to play an important role in guiding academic and extension activities of the Centre. The campus is lively and vibrant with active support from administrative and scientific staff.

The Centre has published 13 high quality educational monographs, seven multimedia packages, several books and numerous scientific papers. Four educational monographs are at the final stages of publishing. A Kannada multimedia package entitled 'Vigyana Kaliyona (Samputa 1)' first in the series "Learning Science", produced by the Centre was released by Prof B K Chandrashekar, Hon. Minister for Primary and Secondary Education, Government of Karnataka, on March 3, 2004. The Faculty members of the Centre have received a number of national and international awards and recognitions for their contribution to the advancement of science and technology.

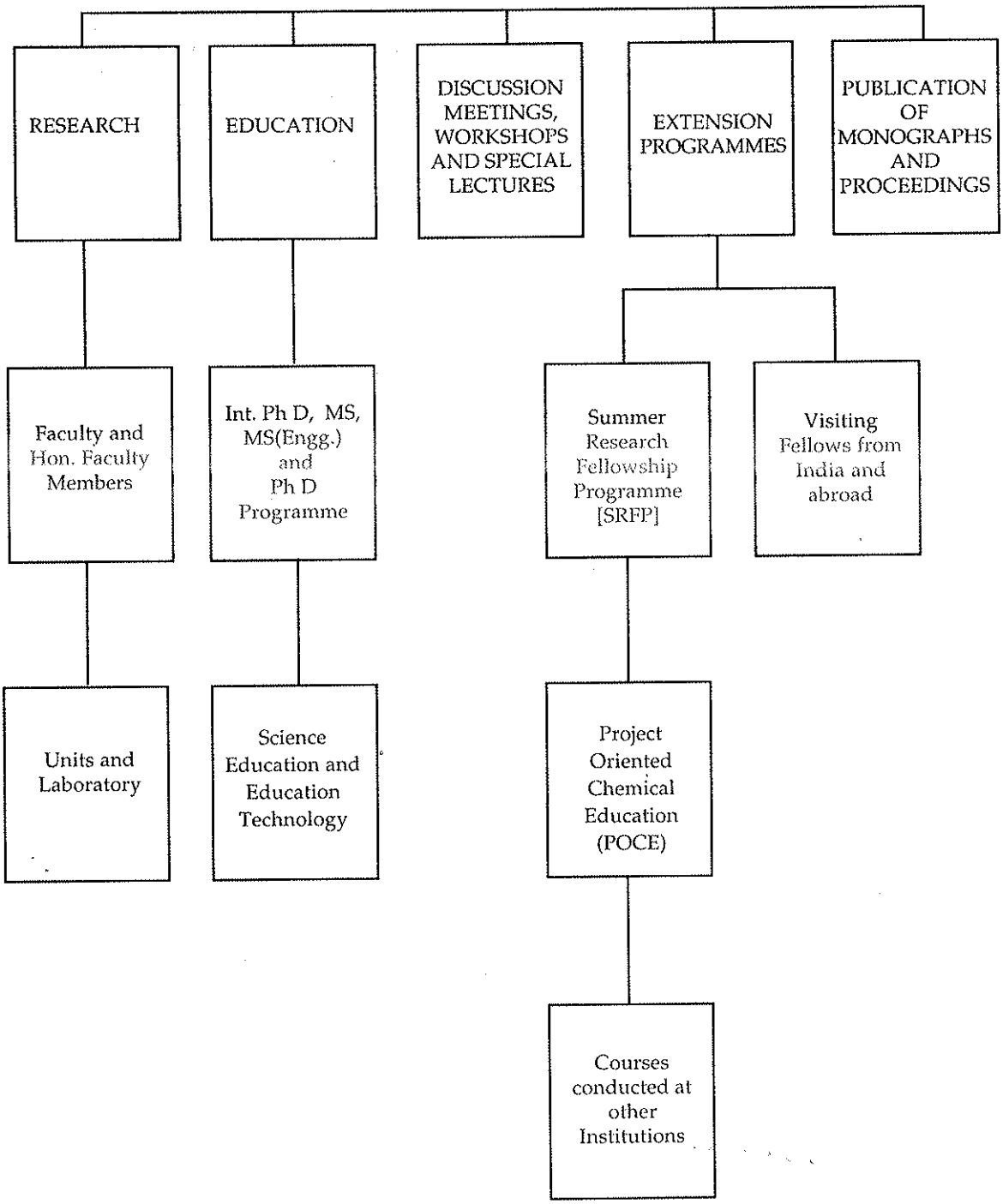
The Centre was honoured by the visit of His Excellency, the President of India, Dr A P J Abdul Kalam, on 7th June 2003. After visiting the laboratories at the Centre and interacting with the students and faculty, Dr Kalam was all praise for the ongoing research activities at the Centre.

The Honorary Fellowship of the Centre was conferred on Prof M M Sharma, D S Kothari Research Professor, Mumbai, on 9th October 2003.

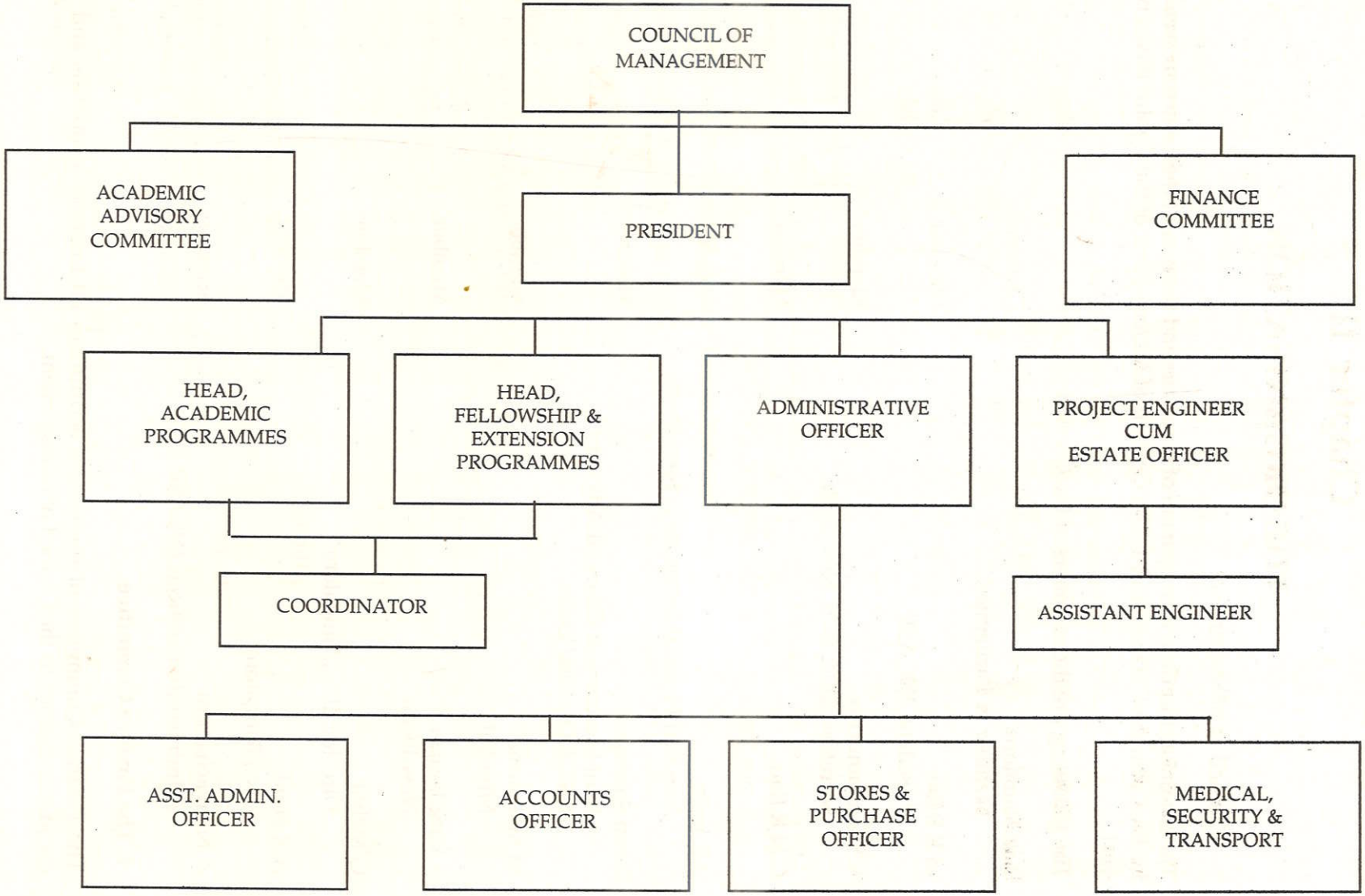
Summer Research Fellowships, Project Oriented Chemical Education Programme, Visiting Fellowships, Extension Programmes and Academic Exchange Programmes of the Centre have attracted wide attention. Since April 2003, 23 Discussion Meetings/Workshops were conducted, either wholly or partially supported by the Centre. In addition, 50 seminars were also held at the Centre.

# 5. ACTIVITIES CHART

## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH



## 6. ORGANISATION CHART



# Chapter II

## THE ORGANISATION

### 1. Council of Management

The administration and management of the affairs and finances of the Centre are conducted by the Council of Management. The Council of Management of the Centre meets twice a year.

The following are the members of the Council:

| | |
|---|---|
| Raja Ramanna<br>Member of Parliament | Chairman |
| M R S Rao<br>President, JNCASR | Member |
| V S Ramamurthy<br>Secretary, DST, GOI, New Delhi | Member |
| C N R Rao<br>Linus Pauling Research Professor, JNCASR | Member |
| S K Joshi<br>National Physical Laboratory, New Delhi | Member |
| Arun Sharma<br>Joint Secretary & Financial Adviser<br>DST, GOI, New Delhi | Member |
| M M Sharma<br>Mumbai | Member |
| S Varadarajan<br>New Delhi | Member |
| G Mehta<br>Director, IISc., Bangalore | Member |
| A K Sood<br>IISc., Bangalore | Member |
| A N Jayachandra<br>Administrative Officer, JNCASR. | Secretary |

### 2. The Finance Committee

The Finance Committee of the Centre scrutinizes all financial proposals and makes recommendations to the Council of Management.

The constitution of the Finance Committee is as follows:

| | |
|---|---|
| M R S Rao<br>President, JNCASR | Chairman |
| C N R Rao<br>Linus Pauling Research Professor, JNCASR | Member |
| Arun Sharma<br>Joint Secretary & Financial Adviser<br>DST, GOI, New Delhi | Member |
| A K Sood<br>IISc., Bangalore | Member |
| R S Gururaj<br>Accounts Officer, JNCASR | Member |
| A N Jayachandra<br>Administrative Officer, JNCASR | Secretary |

**3. The Academic Advisory Committee**

The functions of the AAC includes planning, execution and coordination of research and other academic activities of the Centre. It also regulates the courses of study, procedure for admission of students, examination, etc. It meets at least twice a year. The Committee makes its recommendations to the Council of Management.

The members of the Committee are:

| | |
|---|---|
| M R S Rao<br>President, JNCASR | Chairman |
| C N R Rao<br>Linus Pauling Research Professor, JNCASR | Member |
| Debashish Mukherjee<br>IACS, Kolkata | Member |
| Dipankar Chatterji<br>IISc., Bangalore | Member |
| N Kumar<br>Director, RRI, Bangalore | Member |
| P Rama Rao<br>ISRO Brahm Prakash Distinguished<br>Professor, ARCI, Hyderabad | Member |
| P Ramachandra Rao<br>Vice-Chancellor, BHU<br>Varanasi | Member |

| | |
|---|---|
| N Mukunda (up to 31.12.2003)<br>Head, Academic, Fellowships &<br>Extn. Programmes, JNCASR | Member |
| M K Chandrashekaran (from 1.1.2004)<br>Head, Academic, Fellowships &<br>Extn. Programmes, JNCASR | Member |
| K VijayRaghavan<br>Director<br>NCBS, Bangalore | Member |
| A N Jayachandra<br>Administrative Officer, JNCASR | Secretary |

**4. Faculties**

The faculties are involved in the academic activities of the Centre and assist the Academic Advisory Committee in discharging its functions. The last Annual Faculty Meeting was held in November 2003 which included lectures by the faculty on the advances made in various research areas. Local faculty meetings were held in August 2003 and February 2004 to review the progress and provide input wherever required.

**5. Administration**

President
M R S Rao, Ph D (IISc), F A Sc, F N A, F N A Sc, F T W A S

Head, Academic, Fellowships and Extension Programmes
N Mukunda, Ph D (Rochester), F A Sc , F N A (up to 31.12.2003)

M K Chandrashekaran, Ph D (Madras), D Sc (MKU),
F A Sc, F N A, F T W A S (from 1.1.2004)

Administrative Officer
A N Jayachandra, B Com (Mysore), ICWA (Inter)

Assistant Administrative Officer
G Jayaram, B Com (Bangalore)

Coordinator
K Srihari, Ph D (Bangalore) (up to 31.12.2003)
K Santhanam, Ph D (IISc) (from 1.1.2004)

Warden & Student Counsellor
Chandrabhas Narayana, Ph D (IISc)

Associate Warden
Vijay K Sharma, Ph D (NEHU, Shillong)

Accounts Officer
R S Gururaj, B Sc (Mysore) M P Ed (Bangalore)

Secretary to President
A Srinivasan, B A (Hyderabad)

Asst. Stores & Purchase Officer
K Bhaskara Rao, M Sc (Hyderbad), M Phil (New Delhi)

Project Engineer
S Chikkappa, B E (Mysore)

Junior Engineer
Nadiger Nagaraj, DCE

Consulting Medical Officer
B S Subba Rao, MBBS (Mysore)

Consulting Lady Medical Officer
Kavitha Sridhar, MBBS (Bangalore)

Honorary Medical Officers
P H Prasad, B Sc, MBBS (Karnatak), FCCP
G R Naghabhushan, MBBS (Mysore), FCCP, FCGP, P G Dip in M&CH
L Sharada, MBBS (DGO (Madras))
R K Nivedita, MBBS (Mysore)
C Satish Rao, MBBS (Mysore)

Honorary Security Officer
M R Chandrasekhar, B Sc, LL B (Bangalore)

# Chapter III

# UNITS AND LABORATORY

## 1. UNITS

### (i) Chemistry and Physics of Materials

The Unit continued to make significant contributions in the area of materials chemistry and physics during this period. Several strategies have been developed for synthesis of new and novel inorganic nanowires. Transformation of certain molecular precursors to yield materials have been explored. New low-dimensional magnetic solids and novel fluorescence materials have been investigated. Nanolithography using the dip-pen method within an Atomic Force Microscopy (AFM) setup has been achieved and a variety of inks ranging from metals to magnetic oxides have been employed. Electronic charge densities in several hydrogen bonded solids have been determined using x-ray diffraction. Non-ideality in mixtures of water-alcohols have been studied using molecular beams. Conducting AFM measurements have been carried out on 2-dimensional nanocrystalline metal layers. Temperature dependent Raman and Brillouin scattering experiments on hole doped manganite systems, such as $La_{0.77}Ca_{0.23}MnO_3$ and $Nd_{0.5}Sr_{0.5}MnO_3$ have been carried out. The transition from low spin to intermediate spin state in $LaCoO_3$ has also been studied using temperature dependent Raman experiments. The Verwey transition in $Fe_3O_4$ has also been investigated using Brillouin experiments. *Ab initio* simulation studies have revealed the possibility of an induced dipole moment in supercritical carbon dioxide, an environmentally benign solvent. Molecular simulations of poly(ethylene glycol) and poly(ethylene oxide) have been studied and a premelting transition has been observed in these systems. The hydration layer of heat stable enterotoxin has been investigated using large scale molecular dynamics simulations and differential water dynamics, that correlates with the function of this protein has been observed. A ten node Beowulf supercomputer using commodity components and gigabit network has been indigenously built for molecular simulations. Projects related to memory effects in polymer field effect transistors using optoelectronic methods have been completed. Spatially resolved photocurrent in organic planar structures over a wide length scales have been accomplished. Conducting Polymer (PEDOT:PSS)-Membrane Protein (bR) interfaces has been studied. Electric Field driven instabilities formed on elastomeric surfaces are currently being probed. A facility to study the sensitivity of gas sensors has been setup. Nanosized powders of ZnO-Co have been synthesized using the sol-gel method for gas sensor applications.

The following are the members of the Unit:

**Chair**

C N R Rao — Ph D, D Sc, F A Sc, F N A, F R S, F T W A S, Hon F R S C

**Hon Professors**

A K Sood — Ph D, F A Sc, F N A

A K Raychaudhuri — Ph D, F A Sc, F N A

**Associate Professors**

| | |
|---|---|
| G U Kulkarni | Ph D |
| K S Narayan | Ph D |
| S Natarajan | Ph D |
| A R Raju | Ph D |

**Faculty Fellows**

| | |
|---|---|
| S Balasubramanian | Ph D |
| N Chandrabhas | Ph D |

**Technical Officer**

| | |
|---|---|
| V Sreenath | BE |

**Technical Assistants**

| | |
|---|---|
| S Srinivas | BE |
| Usha Govind Tumkurkar | M Phil |

**Lab Assistants**

| | |
|---|---|
| J Anil Kumar | DEE |
| B S Vasudev | BE |
| Basavraj Devaramani | DEE |
| Alla Srinivasa Rao | DECE |

**Research Associates**

P John Thomas
Manashi Nath
Suman Cherian

**R & D Assistants**

T R Anupama
A G Manoj
S Ratnesh Kumar
Reji Thomas
Sagar Sen
Sajini Anand
N R Selvi
L Sudheendra
S Sunil Kumar

**(ii) Chemical Biology**

Enantiospecific total synthesis of (+)-panepophenanthrin, (-) Cycloepoxydon and novel antifungal agent (±)-Jesterone has been accomplished. Synthesis of β-allose and its 2C-branched homologue from cyclooctatetraene has been carried out. Synthesis, molecular structure and the novel supramolecular architecture of trithia-[3]-peristylane has been reported.

Two new cyclohexadepsipeptides have been isolated from the fungus Isaria. The Fungal growth in solid media yielded hyphal strands from which peptide fractions can be readily

isolable by organic solvent extraction. Two novel cyclodepsipeptides Isaridin A and Isaridin B have been isolated by reverse phase HPLC, followed by characterization by electrospray ionization mass spectrometry and 500MHz $^1$H NMR. Single crystals of both peptides and their three-dimensional structures elucidated by X-ray diffraction have been obtained.

A gradient PCR based screen for use in site directed mutagenesis has been reported. Re-evaluation and refinement of an automated procedure for modeling of disulfide bonds in proteins has been carried out. Thermodynamic effects of replacements of Pro residues in helix interiors of maltose binding protein (MBP) have been studied. Effect of signal peptide on the stability and folding kinetics of MBP has been studied.

Synthesis of new Cu (II)-chelating ligand amphiphiles and their esterolytic properties in cationic micelles have been studied. New ratiometric fluorescence probes as strong sensors of surface charge of lipid vesicles and micelles have been discovered. Synthesis and characterization of novel cationic lipid and cholesterol coated nanoparticles and their interactions with dipalmitoyl phosphatidylcholine membranes have been obtained.

A facile synthesis, aggregation behavior, and cholesterol solubilization ability of avicholic acid was observed. A new bile acid derived lariat ether was synthesized and evaluated for its cation binding properties. Ten phosphonobile acids were synthesized and their micellar, gelation and cholesterol solubilization properties were extensively studied.

The following are the members of the Unit:

**Chair**

Uday Maitra Ph D, FA Sc.

**Professor**

| | |
|---|---|
| V Krishnan<br>(Hindustan Lever Research Professor) | F A Sc, F N A, F T W A S |

**Hon Professors**

| | |
|---|---|
| P Balaram | Ph D, F A Sc, F N A |
| G Mehta | Ph D, F A Sc, F N A |

**Hon Faculty**

| | |
|---|---|
| Raghavan Varadarajan | Ph D, F A Sc |
| Santanu Bhattacharya | Ph D, F A Sc |

**Research Associate**

| | |
|---|---|
| Uday Kumar Kundu | Ph D |

**(iii) Condensed Matter Theory**

The members of the Condensed Matter Theory Unit (CMTU) are engaged in theoretical research on a variety of frontier areas of Condensed Matter Physics and Chemistry. Some specific research topics pursued by them with support from JNCASR are listed below. During 2003-04, they made significant progress on several problems in each of these areas. The specific advances made can be gleaned from the publications.

- **Strongly Correlated Electronic Systems**: *d*-wave superconductivity in cuprates, cobaltates, etc.; kinetically-driven magnetism in double perovskites and dilute magnetic semiconductors; colossal magneto resistance, and spin, charge and orbital ordering in manganites; metal-insulator transitions; dis-ordered and quasi-periodic electronic systems; low dimensional systems such as quantum wires and spin chains; exactly solvable and integrable models; spin-ice and other frustrated spin systems.

- **Soft Condensed Matter**: vortex matter in type-II superconductors; semi-flexible polymers; charged micellar systems; porous networks and biomembranes; solvation in complex liquids; colloidal suspensions; surfactant solutions; liquid crystals.

- **Nonequilibrium Statistical Physics**: drifting flux lattice; sedimentation; stick-slip phenomena; martensitic transformations; fluid and magnetohydro-dynamic turbulence; spatiotemporal chaos in excitable media; driven diffusive systems; slow dynamics near the glass transition; dynamics of evolving networks; growth of thin films in molecular beam epitaxy; protein folding and association.

The following are the members of the Unit:

**Chair**

H R Krishnamurthy Ph D, F A Sc, F N A

**Hon Professors**

| | |
|---|---|
| Biman Bagchi | Ph D, F A Sc, F N A, F T W A S |
| Chandan Dasgupta | Ph D, F A Sc, F N A |
| N Kumar | Ph D, F A Sc, F N A, F T W A S |
| T V Ramakrishnan | Ph D, F A Sc, F N A, F T W A S |
| S Ramasesha | Ph D, F A Sc. |
| D D Sarma | Ph D, F A Sc, F N A |
| B Sriram Shastry | Ph D, F A Sc, F N A, F T W A S |

**Hon Faculty**

| | |
|---|---|
| G Ananthakrishna | Ph D, F A Sc |
| Binny J Cherayil | Ph D |
| Diptiman Sen | Ph D, F A Sc |
| Rahul Pandit | Ph D, F A Sc |
| Sanjay Jain | Ph D |
| K L Sebastian | Ph D, F A Sc |
| Sriram Ramaswamy | Ph D, F A Sc |
| S Yashonath | Ph D, F A Sc |

**R & D Assistants**

Bidisa Das
Kinson C Karan
Suwarna Datar

**(iv) Education Technology**

Three CD-ROMs (multimedia packages) were developed during the year 2003-2004.

1. The Hindi version of 'Understanding Chemistry' entitled *'Rasayan Vigyan Samajna'* was developed for DST.

2. *'Bhugola Parichaya'* a Kannada multimedia package, which covers the subject area of geography, was developed and 1000 copies were replicated for DSERT.

3. The *Vignyana Kaliyona (Samputa 1)*, first in the series of four CD-ROMs being developed for DSERT was released at a function by Prof B K Chandrashekar, Minister for Primary and Secondary Education, Government of Karnataka. 1050 copies of the book and CD-ROM were passed on to the Government.

The following are the members of the Unit:

**Incharge**

| | |
|---|---|
| V Krishnan | Ph D, F A Sc, F N A, F T W A S |

**Coordinator (Hon)**

| | |
|---|---|
| Indumati Rao | M A, M S, C E |

**Technical Assistant**

| | |
|---|---|
| Jatinder Kaur | M Sc |

**Multimedia Asst. (Hon)**

| | |
|---|---|
| Sanjay Rao | B Sc, Cert. Multimedia |

### (v) Evolutionary and Organismal Biology

The Unit conducts advanced research in two laboratories. The research highlights are as follows:

*Chronobiology Laboratory:*
*Drosophila melanogaster*: Establishment of mRNAs of the clock genes *period (per), timeless (tim), Clock (clk)* and *chryptochrome (cry)* oscillate with a 24-hour periodicity.

Lithium treated flies showed reduced activity with an increase in period length of the locomotor activity rhythm. This period lengthening effect occurs at concentrations similar to plasma levels of lithium used in treatment of patients with bipolar disorders.

Lack of circadian integrity reduces lifespan of *Drosophila melanogaster.*

Activity rhythms in the ant *Camponotus compressus*: This is the first report that showed the major workers (foragers) have robust circadian clocks, whereas minor workers (nurses) do not have clocks.

Clocks for sex: We have discovered the loss of circadian rhythms in ants after mating. There is evidence for possible shift-work schedules in the patterns of the circadian rhythms in the locomotor activity of worker/forager ants.

*Evolutionary Biology Laboratory:*
(a) Evolutionary Genetics: Populations of faster developing *Drosophila* have been created through laboratory selection to investigate genetic control of the timing of developmental events. The laboratory is one among the few in the world that use long-term natural selection approaches to study problems in evolutionary genetics.

*(b) Population Ecology:* Experimental and theoretical studies are in progress to have better understanding of dynamic behaviour and demographic stochasticity of metapopulations. Studies on Indian species of Drosophilids are also being undertaken to examine the generality of life-history tradeoffs. The role of stress resistance in life history evolutions is also being studied.

The following are the members of the Unit:

**Chair**

| | |
|---|---|
| M K Chandrashekaran | Ph D, D Sc, F A Sc, F N A, F T W A S. |

**Honorary Professors**

| | |
|---|---|
| Raghavendra Gadagkar | Ph D, F A Sc, F N A |
| Vidyanand Nanjundiah | Ph D, F A Sc, F N A |

**Associate Professor**

| | |
|---|---|
| Amitabh Joshi | Ph D, F A Sc, F N A Sc |

**Faculty Fellow**

| | |
|---|---|
| Vijay K Sharma | Ph D |

**Jr Scientific Assistant (Academic Section)**

| | |
|---|---|
| A V Nagarathnamma | M Sc |

R & D Assistants

D Anitha
V Byregowda
K K Febita
S V Ganesan
J Mohan
L Purushothama
Vinayaga Srinivasan

**(vi) Engineering Mechanics**

The work on computing radiant fluxes and cooling rates in the atmosphere has led to a new and fast code which, for the first time, can make the computations all the way down to the surface (within a millimetre of ground). A paper based on this code has now been published and is being adapted for incorporation into a general circulation model.

The work on limiting velocities below which laws governing natural convection are valid has also been completed and published. Work on connections between solar process parameters and Indian monsoon rainfall has made excellent progress, and a paper will be presented at the meeting of the European Geophysical Union at Nice, France in April 2004.

A paper summarizing the conclusions of an extensive study of the boundary layer flow on the leading edge of a swept wing, in particular involving relaminarization and retransition under high lift conditions, was presented at a meeting of the American Institute of Aeronautics and Astronautics in January 2004.

Instabilities and pattern formations in complex fluids (e.g. dry granular media, inertial suspensions and bubbly flows) are currently being investigated via linear stability analysis and bifurcation theory. Based on this work, a paper has been submitted to the Journal of Fluid Mechanics (February 2004).

Some work on the non-Newtonian rheology of granular fluids had been carried out via Molecular Dynamics (MD) simulations and was published. This work is currently being pursued from a theoretical viewpoint of developing rheological models for the whole range of densities.

A hydrodynamic theory for Brazil-nut segregation has been developed (through a collaboration with a group in Germany) and was published. Work towards a unified theoretical model is currently being pursued.

Simulation and theoretical works on certain microscale flows are currently being developed.

Using vortex-simulation of free-shear flows, we were able to show the relation between large-scale, coherent structures and the process of entrainment. These simulations also indicated that a jet subjected to mild acceleration would have lower entrainment. Preliminary experimental results indicate that increasing ambient viscosity will reduce jet entrainment. From these results an entrainment model was proposed that relates shear instability and the entrainment process.

Study of double diffusive convection using 2-D numerical simulations and Hele-shaw cell experiments have identified the parameters that affect the size of fingers. We also observed transitions in the growth and development of fingers in the Hele-shaw cell.

Study of lifted temperature minima in the field has been continued with the addition of relative humidity and low-velocity wind probes. Much of the standardization of the experiments has been completed. In the current year we will be able to carry out a parametric study of the phenomenon.

Flow visualization studies using an insect-model have revealed that even a single-degree-of-freedom flapping motion can be used for lift generation by introducing asymmetry in the flapping velocity during up-stroke (low velocity) and down-stroke (high velocity). These results are being communicated for journal publication.

A connection between secondary instability and transition is being investigated, by means of stability analyses and stochastic simulations of turbulent spot growth in the transition zone. A multigrid technique has been developed for the direct numerical solution of spatially developing flows. A mechanism for the segregation instability of particulate flow in rotating cylinders has been proposed.

The minimal composite theory for the stability of spatially developing flows developed earlier has been extended to compressible flows. A method has been developed to use our knowledge of the higher order effects to obtain accurate estimates of disturbance amplitudes from the results of this theory.

The following are the members of the Unit :

**Chair**

R Narasimha — Ph D, F A Sc, F N A, F R S

**Associate Professor**

Rama Govindarajan — Ph D

**Faculty Fellows**

| | |
|---|---|
| Meheboob Alam | Ph D |
| K R Sreenivas | Ph D |

**Fellow**

| | |
|---|---|
| K Sanjeev Rao | Ph D |

**R & D Assistants**

Amit Kumar Khatri
Faraz Mehdi
P L Manjunath
E Raja Kumar
Vijaya Kumar Chikkodi

### (vii) Geodynamics

The thrust of research endeavours is the studies on tectonic movements that have taken place in the Late Quaternary time. Mainly field-based, the investigations relate to reactivation of older faults and fissures, rapid rise of mountain ranges, drainage development including formation and disappearance of lakes in essentially riverine regimes, reshaping of landscape, and geomorphic rejuvenation of older mature topography. The neotectonic studies aim at gaining insight into the mechanism of recent movements — the quickened pace of which generates hazardous events — and obtaining information on climate changes in the past 50,000 years.

The focus of attention at present is on the Southern Sahyadri mountain and coastal terrain in Central Kerala in South Indian Shield in the south and on the Himadri – Tethys Himalaya transition zone in Central Himalaya in the north.

**Chair**

| | |
|---|---|
| K S Valdiya | Ph D, F A Sc, F N A, F N A Sc, F T W A S |

### (viii) Molecular Biology and Genetics

Research in MBGU is focused in the areas of infectious diseases, chromatin organization and transcription regulation, developmental biology and genetics. Given below is a brief outline of work done during the period 2003-2004 along with future plan of work.

*Developmental Biology and Genetics Lab.*

Our aim is to analyze pathways involved in vascular development, towards a comparative analysis of the origins and functions of circulatory systems in vertebrate and invertebrate models. These studies will provide tools to analyze the large variety of human cardiovascular disorders. We have identified two novel, evolutionarily conserved genes, *asrij* and *rudhira*, using embryonic stem (ES) cell-derived embryoid bodies and mouse models. Both genes express in undifferentiated ES cells and are later regulated in a stage and tissue -specific manner to show predominant vascular expression. *Asrij* expression in mouse embryonic mesodermal clusters precedes that of the earliest vascular precursor marker Flk-1 (VEGFRII). Rudhira is a WD40 domain protein that is down regulated in cancer cell lines and maps to break points of hematological neoplasms.

Analysis of the novel genes identified to elucidate their function and regulation during vascular development will be continued. Specifically we will analyze *asrij* function in

endocytosis by blocking endocytic pathways by specific inhibitors followed by analysis of its effect on *asrij* function. We will also analyze the effect of *asrij* null mutations on the expression of various endocytic pathways, by microarray analysis. For *rudhira* we will determine proteins that interact with its WD40 domains and thereby identify the signaling pathways through which *rudhira* may act. We will also investigate the role of *rudhira* in tumor progression.

Molecular genetics of non-syndromic deafness and Juvenile Epilepsy Syndrome are the focus of studies in the area of human genetics. As deafness is genetically heterogeneous, genetic studies on a large collection of families are important to acquire reasonably good understanding of genetic architecture and complexities of deafness in the country. Training workshops aimed at the genetics of communication disorders for the interested members of the clinical and genetic community have been conducted at the Centre and other participating centres in the country. An Indo-US workshop to be held at National Institute of Hearing Handicapped, Mumbai is being currently planned.

Evidence for substantial hereditary contribution to the etiology of juvenile epilepsies is well established. Four genetic loci are known so far and we are analysing these genomic locations for susceptibility to the disorder in families collected from southern parts of the country. This study on epilepsy (as well as deafness research) is the first of its kind in the country both in terms of its scale and the participation of members of the clinical neurology community in this projects involving human genetics. Hearing Handicapped, Mumbai; Maulana Azad Medical College, New Delhi; Centre for Human Genetics, Bangalore; Dr. ALM Post Graduate Institute of Basic Medical Sciences, Chennai and JNCASR, Bangalore, and additional 12 collaborators from various parts of the country are involved in this project.

*Chromatin organization and transcription regulation Lab.*

Regulation of eukaryotic (human) transcription from chromatin template with special emphasis on disease is being actively pursued. The areas of interest are:

(i) Regulation of p53 function by nonhistone chromatin associated proteins, (ii) Role of higher ordered chromatin structure and histone chaperones in transcription regulation, (iii) Functional genomics of transcriptional coactivators, (iv) Small molecule modulators of histone modifying enzymes, which may serve as lead compounds for different therapeutics. These studies have led to the identification of a physiological role for the positive coactivator, PC4 that involves activation of p53 function through a unique mechanism. Recently, two cell permeable HAT inhibitors have been discovered. These small molecule compounds could serve as lead compounds for several therapeutic purposes (e.g., cancer or AIDS).

Future goals are to study the (i) mechanisms of p53 activation by non histone chromatin associated proteins; (ii) role of higher ordered chromatin organization in transcription regulation and disease; (iii) cellular functions of human transcriptional coactivator PC4; (iv) functional genomics of different transcriptional coactivators, and (v) identification of more specific and cell permeable histone acetyltransferase and methyl transferase modulators as new therapeutics.

Global chromatin remodeling is an important event during mammalian spermatogenesis, particularly with respect to (a) genetic recombination at the pachytene interval and (b) during final stages of spermiogenesis. We have been interested in studying the influence of histone variant and transition proteins TP1 and TP2 in the chromatin remodeling process. We have identified novel zinc finger modules in TP2 and have demonstrated that it binds

to GC rich DNA through its zinc fingers. We have recently shown that phosphorylation and dephosphorylation cycle plays an important role in chromatin condensation as well as the import of TP2 into spermatid nucleus.

In future, we would like to characterize the import machinery that is responsible for the transport of TP1 and TP2 into spermatid nucleus and the effect of phosphorylation on its interaction with the protein components of the import machinery.

*Infectious diseases Lab.*

The diseases under study are malaria and HIV. Two of the laboratories in this unit study different aspects of the malaria parasite *Plasmodium falciparum* where research is broadly focused on studying essential metabolic pathways with the aim of developing them as drug targets.

The first laboratory has contributed significantly to the understanding of protein and fatty acid biosynthetic pathways in the parasite. Efforts are on to dissect these two pathways and develop specific inhibitors for some of the essential enzymes/proteins which alone or in combination with other antimalarials/inhibitors may be more effective. Towards achieving this goal few inhibitors for fatty acid synthesis pathway have been designed and synthesized. As this pathway is taking place in 'Plastid', it is of prokaryotic nature, intrinsically different from that operating in the eukaryotic host. Thus, the inhibitors for this pathway would be specific for the parasite. Future plans include characterization and crystallization of the enzymes of the pathway to understand structure-function relationship, which eventually would help in the design of effective inhibitors. The efficacy of combination therapy using triclosan and other antimalarials/antibiotic/other inhibitors will be evaluated.

The second laboratory working on *Plasmodium* has focused its attention on enzymes from the glycolytic (triosephosphate isomerase), purine salvage and hemoglobin degradation pathways. Hypoxanthine guanine phosphoribosyltranseferases (HGPRTs) of the purine salvage pathway exhibit species-specific differences in their ability to phosphoribosylate the three oxo-purines hypoxanthine, guanine and xanthine. In an attempt to elucidate the structural basis for substrate specificity an approach involving enzymology of chimeric and randomly mutated HGPRTs was adopted. This has led to the identification of residues, though distal from the catalytic pocket, that modulate substrate specificity. Studies on the recombinant, purified *P. falciparum* HGPRT indicate that the active form of enzyme is metastable and the more stable form is inactive.

The structure of *P. falciparum* adenylosuccinate synthetase (AdSS), another enzyme in the purine salvage pathway, has been obtained at 2Å resolution in collaboration with Prof M R N Murthy, MBU, IISc. Detailed kinetic studies showed that the kinetic mechanism of the parasite enzyme differs from that of homologs from other species in being ordered. Analysis of the structure helps explain the unique features of the parasite enzyme. Plan for the next year involves structure elucidation of various complexes of a xanthine active variant of human HGPRT, generation of mutant *P. falciparum* HGPRTs that do not exhibit metastability, confirmation of the kinetic mechanism and further crystallographic analysis of *P. falciparum* ADSS, refolding of recombinant *P. falciparum* inosine monophosphate dehydrogenase from inclusion bodies.

The focus of third laboratory is on both basic and applied aspects of the HIV/AIDS research. The thrust areas of work at JNC may be classified under three categories, study of the molecular, immunological and pathogenic properties of the subtype-C viruses of HIV-1; engineering, evaluating and optimizing DNA vaccines by the strategy of incorporating

molecular adjuvants and developing molecular and immunological diagnostics for HIV. In collaboration with NIMHANS and Albert Einstein College of Medicine, the group at JNCASR has identified a natural variation in the C-Tat protein and showed that this viral protein is defective for monocyte chemotaxis which could be the reason for the low incidence of HIV-associated dementia reported in India. Secondly, three different strategies that involve codon optimization of Tat genes for mammalian expression, use of ubiquitin as an adjuvant to prime cellular immune responses and use of complement protein C3d to prime humoral immune responses to augment Tat-specific immune responses in mice have been evaluated. These studies are the first attempts at employing a subtype-C derived Tat gene in vaccine design.

With the aim of Molecular characterization of HIV-1 subtype distribution in India a nested PCR strategy, as a more rapid and efficient alternative for genotyping of HIV-1 by HMA has been developed. Using this assay, nearly 650 samples from several rural and urban towns and, cities in all the four southern Indian states and West Bengal have been screened. The epidemic is predominantly characterized by subtype-C, however, a small number of recombinants and non-C viruses were identified.

This is also the first time that B/C recombinant viruses have been identified in India. Finally, the group in collaboration with Microtest Innovations Pvt Ltd, Bangalore, Bharat Biotech, Hyderabad and DST has developed a viral antigen capture assay with a sensitivity of 50 pg/ml of sample for detection of HIV1 and HIV2.

Future work will focus on the influence of C-Tat on the recruitment of monocytes to brain by indirect mechanisms, evaluation of the X4-antagonistic property of C-Tat, C-Tat Transgenic mice (in collaboration with Dr. Vinayaka Prasad, AECOM), differential host gene expression regulation by C-Tat vs B-Tat pathological significance of the signature amino acid residues to C-Tat, optimization of DNA vaccines, analysis of the importance of subtype-C unique NF-kB site in C-LTR gene expression regulation, evaluation of an Indian traditional medicine as an anti-HIV therapy, development of a viral-load assay using the real-time PCR strategy (in collaboration with Xcyton, Bangalore).

The following are the members of the Unit:

**Chair**

| | |
|---|---|
| Dipankar Chatterji | Ph D, F N A Sc, F A Sc, F N A |

**Professor**

| | |
|---|---|
| M R S Rao | Ph D, F A Sc, F N A, F N A Sc, F T W A S |

**Honorary Professor**

| | |
|---|---|
| H Sharat Chandra | Ph D, F A Sc, F N A |

**Associate Professors**

| | |
|---|---|
| Anuranjan Anand | Ph D |
| Hemalatha Balaram | Ph D |
| Namita Surolia | Ph D, F A Sc |

**Faculty Fellows**

| | |
|---|---|
| Maneesha Inamdar | Ph D |
| Ranga Uday Kumar | Ph D |
| Tapas Kumar Kundu | Ph D |

**R & D Assistants**

V Aruna
Ankita Prakash
Anuradha
Aparna Jayachandran
Brahmanaspati G Sastry
Chitra Rajgopal
P G Christopher
Hari Kishore
R Jayalakshmi
K M Mohan Kumar
Mohd. Altaf Bhat
R Nagendran
Prejo Philip
Priyaranjan Pattanaik
Radhika A Varier
A S Raghavendra
A K Rajan
S Raspudin
H M Ravishankar
Roopesh Udupa
Sandeep Paul
A Sankar Ganesh
Santhosh Girirajan
Sravan Kumar
R Sridhar
Sriranjini
Sucheta Murthy
Venkatesh Prasanna
Vikas Malhotra

**(ix) Theoretical Sciences**

Many condensed-matter systems are studied by a variety of theoretical and numerical methods by the members of the TSU. The problems studied include the statistical properties of fluid, passive-scalar, and magnetohydrodynamic turbulence, the characterisation and control of spiral turbulence in models for cardiac arrhythmias, and the properties of phases in lattice models for interacting bosons. The modelling of solids via ab-initio density-functional calculations on solids is an important area of research. These have been used, inter alia, for ferroelectrics and for surface-physics problems to calculate on surface structures and vibrational modes in noble and transition metals. A variety of computational and semi-analytical methods have been used to elucidate slow dynamics in glass-forming and network-forming liquids with special emphasis on thermodynamic aspects and analysis of the energy landscape and its role in determining dynamical and thermodynamic behaviour of glass formers. In network-forming liquids, like water, silicon and silica, studies of structural changes, liquid-liquid phase transitions, and metal-insulator transitions have been carried out. Quantum-many-body methods have been used to study giant and colossal-magneto-resistance materials, optical and transport properties of organic molecules and conjugated polymers, inorganic solids, and simple and complex insulators close to metallicity, nanoclusters, magnetic semiconductors, and biomolecular systems. Some of the progress made in these areas is described briefly below.

Significant progress has been made in extending dynamic scaling of time-dependent correlation functions in critical phenomena to dynamic multiscaling of time-dependent velocity structure functions in fluid turbulence. Noise correlations in shear flows have been elucidated in recent work. The decay of magnetohydrodynamic turbulence from power-law initial conditions has been studied in detail. The statistical mechanics of semiflexible equilibrium polymers has been studied via computer simulations of an off-lattice model that has been developed for self-assembling monomers. Ventricular fibrillation and its characterization and control has been studied extensively in the context of a variety of partial-differential models for cardiac tissue. Superfluid, Mott-insulating, and mass-density-wave phases have been studied in the context of the one-dimensional extended Bose-Hubbard model.

Extensive studies have been carried out of the reconstruction of Pt(111) and domain patterns on close-packed metal surfaces, such as double-stripe reconstruction of the Pt(111) surface. Exchange-correlation errors at harmonic and anharmonic orders have been studied for the case of bulk Cu. Honeycomb, triangles, and bright-star patterns have been studied theoretically for metal surfaces. Stress, strain and charge transfer have been studied in the Ag/Pt(111) system. The origins of structural stability have been examined for small clusters of Al, Sn and As.

Three themes have been pursued in the studies of supercooled liquids. The first investigates slow dynamics in glass-forming liquids and its relationship to structural changes as characterized by local potential-energy minima sampled by the liquid. The second theme elucidates the relationship between the ultimate boundaries of the liquid state, the liquid-gas spinodal, and the glass-transition line. Extensive computer simulation that have been carried out suggest that, in general, these two boundaries intersect at a finite temperature; this implies the existence of an ideal glass-gas mechanical instability locus at low temperatures. The third theme explores the analogies between network-forming liquids such as water and silicon. Computer simulations have been used to provide evidence for a liquid-liquid phase transition in supercooled silicon similar to that proposed for supercooled water.

Relaxor ferroelectrics and strain and polarization fields in inhomogeneous ferroelectrics have been studied by modelling and simulations. Studies have been carried out of the dielectric properties of pervoskite and related oxides and transition-metal oxides with a view to examining phase transitions in these systems. The effects of proton or water incorporation in perovskite oxides have been elucidated. The first-principles design of magnetic piezoelectrics and semiconductors are also being considered in detail. The metal-insulator phase transition in supercooled liquid Si has been studied via computer simulations. The modelling of the quantum dynamics of protons in biomolecules has been initiated.

Progress has been made in studying the effects of dipole orientations on nonlinear optical properties of oxo- bridged di-nitroaniline systems. Model exact many-body studies have been carried out for charge transfer through bridged systems and for charge ordering in quarter-filled one-dimensional organic conductors and their implications for long-ranged Coulomb interactions. The synthesis, structure, and magnetic properties of a new iron arsenate, [C10N4H28][{FeF(OH)(HAsO4)}4], with a layered structure has been studied. Electrostatic potential profiles and nonlinear currents have been investigated in interacting molecular wires. The ground state and excitations of alternating Spin-1/Spin-1/2 sites in a diamond lattice have been elucidated. Transport in molecular wires with long-range Coulomb interactions has also been examined.

Condensed-matter systems present many challenging problems of both fundamental and technological interest. Our research uses a combination of different approaches, like quantum-many-body theory, electronic-structure calculations, statistical mechanics, and computational fluid dynamics, to tackle these problems. We combine analytical calculations with extensive state-of-the-art computation and ab-initio and empirical models. Over the next year we will continue to use these methods to study phenomena such as turbulence, metal-insulator and glass transitions, and systems like glass- and network-forming liquids, complex fluids, organic molecules, conjugated polymers, inorganic solids, simple, noble and transition metals and their surfaces, ferroelectrics, complex insulators close to metallicity, nanoclusters and nanowires, magnetic semiconductors and biomolecular systems.

The following are the members of the Unit:

**Chair**

| | |
|---|---|
| Rahul Pandit | Ph D, F A Sc |

**Associate Professors**

| | |
|---|---|
| Shobhana Narasimhan | Ph D |
| Srikant Sastry | Ph D |

**Faculty Fellows**

| | |
|---|---|
| Swapan K Pati | Ph D |
| Umesh V Waghmare | Ph D |

R & D Assistants

G Arun
Bhaskar Jyoti Borah
Girish M Gowda
Moumita Maiti
Saju Joseph

## 2. LABORATORY

### Computer Laboratory

Activities in the Computer Lab involve (a) regular day-today maintenance and repair of computers and local network across the Centre (b) keeping the presence of the centre on the web up to date and (c) help users of the central computing facility with computing, printing and other peripheral facilities and (d) maintain backups and network security measures.

In addition, new features are introduced at the Computer Lab to keep up with evolving changes in computing technology. In the year 2003-04 following are the highlights:

jncgate (internet gateway machine) installed
Mail server OS upgraded from Red Hat to Mandrake
Visitor's PC, apollo available in complab
Many new softwares purchased and installed
Upgraded 1 Mbps leased line to 2 Mbps
Reference books acquired and available to users
Proxyserver upgraded
Spam/Virus filtering in mail server started
Upgraded 64 kbps leased line to 1 mbps

The following are the members of the Laboratory:

**Head**

Umesh V Waghmare Ph D

**R & D Assistants**

T R Rajesh Kanna
T K Shithal

## 3. ENDOWED RESEARCH PROFESSORS

1. Defence Research and Development Organisation
   - D S Kothari Chair

   M M Sharma, F R S, F A Sc, F N A

2. Hindustan Lever Ltd.
   - Hindustan Lever Chair

   V Krishnan, F A Sc, F N A, F T W A S
   A Chakravorty, F A Sc, F N A

3. Reliance
   - Linus Pauling Research Professor

   C N R Rao, F A Sc, F N A, F R S, F T W A S, Hon.F R S C

# Chapter IV

## PART – I: ACADEMIC PROGRAMMES

### 1. Academic Activities

The Centre offers regular Ph D., Integrated Ph D, M S and M S (Engg.) degree programmes in Science and Engineering. The Integrated Ph D programme in CPMU is available to those with a B Sc degree. The Centre selects candidates on an all-India basis, offers course work (in collaboration with IISc), provides research facilities, administers the programme and awards the degree. After 3 years of successful completion of the Integrated Ph D programme, candidates are awarded a Master's degree (M S). The Ph D degree is awarded after a period of research and acceptance of a thesis. The regular Ph D programme in science and engineering is available to post-graduates who have successfully completed GATE/ CSIR-UGC-JRF/NET examinations. Graduates in Medicine/Engineering/Technology are admitted for the M S/M S (Engg.) programme. Students in Physics are also admitted through JEST.

#### *(a) Research Admissions*

During the year 2003-2004, 20 students (one student for the Integrated Ph D, 17 students for the Ph D programme and two students for M S(Engg.)) were admitted to work in the following areas:

(i) Chemistry & Physics of Materials

*Integrated Ph D*
Bhuvana

*Ph D*
Dhritiman Gupta
Gopal Krushna Pradhan
Chandra Sekhar Rout
Bhargava, B L
Partha Mahata
Reji Thomas

(ii) Evolutionary & Organismal Biology

*Ph D*
Shampa Ghosh
Gitanjali Howlader

(iii) Molecular Biology & Genetics

*Ph D*
Rinki Ratna Priya
Kiran Batta
Krishnapal Karmodiya
Subhra Prakash Chakravarty
Vani Kulkarni
Venkatesh Prasanna K S
Pradeepa M M

(iv) Theoretical Science

*Ph D*
Shibu Saw
Jaita Paul

(v) Engineering Mechanics Unit

*M S (Engg.)*
Shreyas, V J
Punit Tiwari

***(b) Degrees awarded***

*Ph D*

(i) Chemistry & Physics of Materials Unit

Vinmathi Vanitha
Sachin Parashar
T R Anupama
P John Thomas
L Sudheendra

(ii) Molecular Biology & Genetics Unit

P Pattanaik
Lakshmi Ramakrishna
Sourav Banerjee

**2. Discussion Meetings/Workshops**

The following discussion meetings/workshops have been held since the last report:

Stem Cell Biology, April 20 -21, 2003, Prof Sharat Chandra (IISc), Dr A Anand (JNCASR).

National Seminar on Aerodynamics & Flight Mechanics, May, 1, 2003, Prof K P J Reddy (IISc).

Two week Summer Course on Understanding Science, June 16-27, 2003, Prof R Narasimha (NIAS)

Simposium on Advances in Fluid Mechanics, July 24 – 25, 2003, Prof Rama Govindarajan and Dr K R Sreenivas (JNCASR).

Consortium of students in Management Research 2003, September 20-21, 2003, Prof N J Rao (IISc)

International Conference on Scale Interaction and Variability of Monsoon, October 6 – 10, 2003, Dr Gangan Prathap (C-MMACS, Bangalore).

Conf. on Convergent Technologies for the Asia – Pacific, October 14 – 17, 2003, Prof H P Kincha (IISc.)

Frontiers of Knowledge in the Natural Sciences, Social Sciences, Technology and the Arts, October 27-November 16, 2003, Prof R Narasimha (NIAS).

Emerging Directions in Chemical Sciences, November 26-28, 2003, Profs G U Kulkarni (JNCASR), J Gopalakrishnan and B Bagchi (IISc).

7th Meeting of Transcription Assembly, December, 4 - 6, 2003, Dr Tapas Kumar Kundu (JNCASR).

10th Congress of Federation of Asian & Oceanian Biochemists and Molecular Biologists, December 7 – 11, 2003, Prof M R S Rao (JNCASR).

4th Asian Meeting on Ferroelectrics, December 12-15, 2003, Prof S B Krupanidhi (IISc).

Symposium on Applied Aerodynamics and Design of Aerospace Vehicles, SAROD-2003, December 15-16, 2003, Prof Rama Govindarajan and Mr Biju Uthup (JNCASR).

Diamond Jubilee of Dept. of Aerospace Engg. IISc and Centinary of Powered Human Flight, December 19-20, 2003, Prof B N Raghunandan (IISc).

Inservice Training Programme for High School Science Teachers, December 23, 2003 – January 1, 2004, Prof H L Bhat (IISc).

Third Trivandrum International Symposium on Recent Trends in Photochemical Sciences, January 5-7, 2004, Dr Suresh Das (RRL, Trivandrum).

International Conference on Nonlinear Phenomena, January 5 – 10, 2004, Prof G Rangarajan (IISc).

3rd Global meet on Parasitic Diseases, January 12 – 16, 2004, Prof N J Shetty (Bangalore University).

International Symposium on Cellular and Molecular Biophysics, January 14-17, 2004, Prof N B Joshi (NIMHANS, Bangalore).

IV Annual Meeting of the Indian Society for Study of Reproduction and Fertility, January 23-25, 2004, Prof P B Seshgiri (IISc).

Short Course on Cell Biology, January 29 - February 5, 2004, Prof Manju Bansal (IISc).

NCC 2004: Tenth National Conference on Communication, January 30 - February 2, 2004, Prof G V Anand (IISc).

Materials for the Future MF 2004, March 22-23, 2004, Prof K Chottopadhyay (IISc).

### 3. Colloquia

#### JNC Colloquia

Structural development of vortical flows around a square jet in cross flow, *Dr Amalendu Sau*, Institute of Physics, Academia Sinica, Taipei, Taiwan, September 24, 2003.

Turbulence in deformation of solids, *Prof G Ananthakrishna*, IISc, Bangalore, February 24, 2004.

#### Fluid Dynamics Colloquia

Sonoluminescence and bubble fusion, *Prof Vijay H Arakeri*, IISc, Bangalore, October 8, 2003.

Constancy of the contact angle in viscous flows with pinned contact lines, *Dr P N Shankar*, NAL, Bangalore, October 22, 2003.

Vortex-induced vibrations of a cylinder: Modes of vortex formation and existence of a critical mass, *Dr Raghuraman N Govardhan*, IISc, Bangalore, November 12, 2003.

Steady free fall of rigid bodies in Newtonian and non-Newtonian fluids, *Dr Ashwin Baidya*, University of Pittsburgh, USA, December 17, 2003.

A new wave in the equatorial Indian Ocean from observations and simulation, *Prof Debasis Sengupta*, IISc, Bangalore, January 28, 2004.

Force fluctuations in a dense granular flow, *Prof Narayanan Menon*, University of Massachusetts, Amherst, USA, March 3, 2004.

Dynamic multiscaling in turbulence, *Prof Rahul Pandit*, IISc, Bangalore, March 17, 2004.

**4. Frontier Lectures**

The role of a writer, *Mrs Shashi Deshpande*, Bangalore, April 22, 2003.

Frontier Lectures in Chemistry at IIT Guwahati, *Prof C N R Rao*, JNCASR, and Prof J B Barua, IIT, Guwahati, during 28-30 August 2003

Frontier Lectures in Chemistry at M G University, Kottayam, *Prof C N R Rao*, JNCASR, and *Prof M V George*, RRL, Trivandrum, November 17-19, 2003.

Joys of science: How they led me to science policy, *Prof Bruce Alberts*, National Academy of Sciences, USA, January 14, 2004.

**Special Lecture**

***Linus Pauling Lecture***

Pluripotent stem cells, and the ethical and legal implications of their use, *Dr Anne McLaren*, University of Cambridge, UK, April 29, 2003.

**5. Endowment Lectures**

***Prof V Ramalingaswamy Memorial Lecture In Biology***

Caraka – Physician – Extraordinary of India, *Dr M S Valiathan*, Manipal Academy of Higher Education, November 14, 2003.

***ISRO-Satish Dhawan Lecture***

The equity premium: Current estimates and prospects for change, *Prof Rajnish Mehra*, University of California, USA, December 22, 2003.

***A V Rama Rao Foundation Lectures in Chemistry***

Being and becoming: Quantum systems in intense external fields, *Prof B M Deb*, Panjab University, August 18, 2003.

Turning solids into materials: Chemistry plays a key role, *Prof J Gopalakrishnan*, Indian Institute of Science, August 18, 2003.

Laser photons as specific reagents in organic chemistry, *Prof J P Mittal*, Bhabha Atomic Research Centre, Mumbai, February 26, 2004.

Electronic structure calculations of confined atoms and molecules, *Prof Kalidas Sen*, University of Hyderabad, Hyderabad, February 26, 2004.

***DAE-Raja Ramanna Lectures In Physics***

Frontiers in nuclear fission, superheavy nuclei and nuclear energy, *Prof S S Kapoor*, Bhabha Atomic Research Centre, Mumbai, October 9, 2003.

Quantum computing by nuclear magnetic resonance, *Prof Anil Kumar*, Indian Institute of Science, Bangalore, October 9, 2003.

***C N R Rao Oration Award Lecture***

Photoelectric activity bacteriorhodospin – conducting polymer interface, *Prof K S Narayan*, JNCASR, August 14, 2003

**6. Lectures delivered at the Annual Faculty Meeting by Faculty/Hon. Faculty- to be pulished in Special Issue of the Journal of the Indian Institute of Science**

Entrainment in free shear flows, K R Sreenivas

Optical nonlinearities in insulators, Swapan K Pati

Chromatin-mediated transcription regulation in human and its link to disease: New targets for therapeutics, Tapas Kumar Kundu

Dynamical processes involving long chain molecules, K L Sebastian

DNA Gyrase of mycobacteria as drug target: Development of a new inhibitor with a novel mechanism of action, V Nagaraja

Semiconducting nanocrystals, D D Sarma

**7. Seminars**

Dynamics of particulate flows: Simulation and theory by Dr Mehaboob Alam, JNCASR, Bangalore, April 22, 2003.

Pattern formation in soft films by Dr V Shenoy, IISc, Bangalore, April 25, 2003.

Phytase — A protein with dual function by Prof Deepak Das Gupta, SINP, Kolkata, May 30, 2003.

Kinetic Theory of density fluctuations in one component monoatom fluids at equilibrium: A short time theory for the memory function by Dr Madhav V Ranganathan, Stanford University, USA, June 4, 2003.

Probing genetic instabilities in head and neck cancer: Investigations through genomic approaches by Dr Susanta Roychoudhury, Indian Institute of Chemical Biology, Kolkata, June 23, 2003.

Ground state phases and spectra of low-dimensional antiferromagnets by Prof Rajiv Singh, Univ of California, Davis, July 18, 2003.

Protein misfolding and human diseases by Dr Sudipta Maiti, TIFR, Mumbai, August 11, 2003.

Melting and the potential energy landscape by Prof Charusita Chakravarty, IIT Delhi, August 18, 2003.

Starvation response in Mycobacteria by Prof Dipankar Chatterjee, JNCASR, August 20, 2003.

*Neurospora* Circadian Clocks by Dr Till Roenneberg, Ludwig-Maximilians-University, Munich, September 4, 2003.

Chemistry: Present and Future by Prof C N R Rao, JNCASR, September 5, 2003.

Identification and characterization of novel ERK2 substrates through use of engineered Kinase and ATP analogs by Dr Vinay Nandicoori, September 12, 2003.

Molecular beam epitaxy: A novel technique to synthesize nanostructural materials by Prof A R Raju, JNCASR, September 12, 2003.

Measurements over a flat plate with and without suction by Dr Amit Agrawal, University of Newcastle, Australia, September 16, 2003.

Enzymes: Understanding function through structure and mutagenesis by Prof Hemalatha Balaram, JNCASR, September 19, 2003.

Noise spectroscopy of 1/f non-Gaussian noise and its manifestations in systems with long term correlations by Arup K Raychaudhuri, IISc, Bangalore, September 30, 2003.

Decision making in a humoral response by Prof Kanuri Rao, ICGEB, New Delhi, October 7, 2003.

Heavy Lanthanides: A new approach by Dr Vidhyadhiraja, Oxford University, UK, October 16, 2003.

Extracting equilibrium free energy profiles from nonequilibrium measurements: A discussion on the Jarzynski equality by Dr Abhishek Dhar, Raman Research Institute, Bangalore, November 11, 2003.

Phosphorescence for solid state lighting by Prof Anthony Cheetham, Univ of California, November 24, 2003

Quest for understanding significance of reproductive announcement by Dr Ananthakrishna Sharma, Univ. of Mysore, November 27, 2003.

Understanding physics and chemistry of complex materials by N-MTO method by Dr Tanusri Saha Dasgupta, S N Bose Centre, Kolkata, December 9, 2003.

Slow-fast continuum in ladybirds by Prof A F G Dixon, University of East Anglia, UK, December 11, 2003.

X-ray reflectivity and GISAXS analysis of complex architectures at the nano scale by Prof A Gibaud, University du Maine, France, December 12, 2003.

Metallacarboranes: New synthetic strategies and structural patterns by Prof Narayan S Hosmane, Northern Illinois University, Dekalb, Illinois, December 22, 2003.

Self-assembly of nanotubes from DNA tiles by Dr Deborah K Fyenson, University of California, Santa Barbara, USA, December 23, 2003

Novel universality classes for coupled driven diffusive systems by Dr Abhik Basu, Hahn-Meitner-Institute, Berlin, Germany, January 8, 2004.

Exciting materials: Materials modification by electronic excitation by Prof Marshall Stoneham, University College, London, January 9, 2004.

Understanding neurodegeneration and neural plasticity: From bench to bedside by Dr Madhav Thambisetty, Emori University, USA, January 19, 2004.

Genomic approach to study species populations: Inferring evolutionary history of *Drosophila ananassae* by Dr Aparup Das, Ludwig Maximilians University, Munich, January 21, 2004.

Global chromatin remodelling in development and differentiation by Prof M R S Rao, JNCASR, January 23, 2004.

Molecular self-assembly directed material synthesis in biotic and abiotic environment by Prof Suresh Valiyaveettil, National University of Singapore, January 23, 2004.

Why do we have ferromagnetism in dilute magnetic semiconductors? by Dr Priya Mahadevan, I I T Madras, January 29, 2004.

Water dynamics near a protein surface by Dr Sarika Bhattacharya, IISc, February 3, 2004.

RVB liquid physics by Dr R Moessner, CNRS and Ecole Normale Superieure, Paris, February 4, 2004.

O(N) methods for disordered systems by Dr Vincent Sacksteder, University of Rome, La Sapienza, February 10, 2004.

Complexities in the regulation of T cell death and memory by Dr Vineeta Bal, National Institute of Immunology, New Delhi, February 12, 2004.

Ferromagnetism above room temperature in doped fullerenes by Prof K V Rao, Royal Institute of Technology, Sweden, February 17, 2004.

Theoretical treatment of nanotube-nanotube interactions by Dr A Szabados, Eotvos Lorand University, Budapest, Hungary, February 19, 2004.

Nonlinear optical properties of chiral systems by Prof A D Buckingham, Cambridge University, February 25, 2004.

Quantum dots unlocking the potential by Dr Paul O'Brien, University of Manchester, UK, February 27, 2004.

Pathogenesis of HIV dementia by Dr Avindra Nath, John Hopkins University, USA, March 1, 2004.

Thin film fabrication of YBCO, LBMO and their double layers for tunable microwave filters by Prof Endo, Mie University, Japan, March 3, 2004.

Understanding the past and predicting the future: Insights from population genetics models by Dr Uma Ramakrishnan, Stanford University, USA, March 4, 2004.

Catching molecules in the act: Ultrafast diffraction of transient structures in real time by Prof Ramesh Srinivasan, Caltech University, March 8, 2004.

Role of neuronal ion channels in pacemaker neurons of *Drosophila melanogaster* by Dr V Sheeba, New York University, USA, March 8, 2004.

Ectopic expression of ion channels in pacemaker neurons of *Drosophila melanogaster* modifies circadian phenotypes by Dr V Sheeba, New York University, March 11, 2004.

Organo clays with organized structures - A modern morphology? by Dr Eswara Moorthy, AIST Fellow, March 22, 2004.

Nanomechanics of single biological cells and some connections to human diseases by Prof Subra Suresh, MIT, USA, March 24, 2004.

Unusual nature of the nanodomains in polymer derived ceramics by Prof Rishi Raj, University of Colorado, March 24, 2004.

# PART – II: EXTENSION PROGRAMMES

**1. Summer Research Fellowships/ Department of Science Technology Fellowships / Rajiv Gandhi Science Talent Research Fellowships**

The Centre offers these fellowships for two summer months to bright undergraduate and graduate students. For the year 2004, 153 students were offered fresh fellowships and 35 renewals. Out of this, 50 students are awarded Department of Science Technology Fellowships and 10 students Rajiv Gandhi Science Talent Research Fellowships.

Scientists in nearly 46 institutions across the country listed below are identified to guide these students:

1) Abasaheb Garwara College, ME Society, Pune
2) Banaras Hindu University, Varanasi
3) Bangalore University, Bangalore
4) Bhabha Atomic Research Centre, Mumbai
5) Biocon Ltd., Bangalore
6) Bose Institute, Kolkata
7) Cancer Research Institute, Mumbai
8) Central Drug Research Institute, Lucknow
9) Centre for Advanced Technology, Indore
10) Centre for Biotechnology, New Delhi
11) Centre for Cellular Molecular Biology, Hyderabad
12) Centre for DNA Fingerprinting & Diagnostics, Hyderabad
13) Hamdard University, New Delhi
14) Harish-Chandra Research Institute, Allahabad
15) Indian Association for the Cultivation of Science, Kolkata
16) Indian Institute of Chemical Biology, Kolkata
17) Indian Institute of Information Technology, Hyderabad
18) Indian Institute of Information Technology, Thiruvananthapuram
19) Indian Institute of Science, Bangalore
20) Indian Institute of Technology, Chennai
21) Indian Institute of Technology, Delhi
22) Indian Institute of Technology, Kanpur
23) Indian Institute of Technology, Kharagpur
24) Indian Institute of Technology, Mumbai
25) Indian Statistical Institute, Bangalore
26) Institute of Genomics & Integritive Biology, Kolkata
27) Institute of Microbial Technology, Chandigarh
28) Inter-University Centre for Astronomy and Astrophysics, Pune
29) Jawaharlal Nehru University, New Delhi
30) Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore
31) National Aerospace Laboratory, Bangalore
32) National Brain Research Centre, Pune
33) National Cell Science, Pune
34) National Centre for Biological Sciences, Bangalore

35) National Chemical Laboratory, Pune
36) National Institute of Immunology, New Delhi
37) National Institute of Mental Health and Neuro Sciences, Bangalore
38) North Eastern Hill University, Shillong
39) Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram
40) Raman Research Institute, Bangalore
41) Satellite Application Centre (ISRO), Ahmedabad
42) Tata Institute of Fundamental Research, Mumbai
43) University of Agricultural Sciences, Bangalore
44) University of Delhi, Delhi
45) University of Hyderabad, Hyderabad
46) University of Pune, Pune.

## 2. Academic Exchange Programme

As part of the academic exchange programme, the following scientists/scholars carried out collaborative work with scientists of the Centre and the Indian Institute of Science for varying periods during the year under report.

**Visiting Scientist**

Dr Ayi Anyama Ayi
University of Calabar, Calabar, Nigeria

**Visiting Scholars**

Mr Leskey Mduduzi Cele
Wits University, South Africa

Mr Christopher
University of Calabar, Calabar, Nigeria

Mr Sebastian Gode
University of Rostock, Germany.

## 3. Visiting Fellowship Programme

The Centre offers Visiting Fellowships to research scientists in educational institutions and R&D laboratories, tenable for 2-3 months, to work with the faculty of the Centre.

The following were offered Visiting Fellowships during 2003 - 2004 to work at the institutions as indicated below:

| Name and address of the visitors | Collaborating with |
|---|---|
| Dr R C Meena<br>J N V University, Jodhpur, Rajasthan | Prof T Ramasami<br>Central Leather Res. Institute, Chennai |
| Dr S Kumara Raman<br>Nehru Memorial College, Trichy | Prof A R Raju<br>CPMU, JNCASR, Bangalore |
| Dr R Vijayaraghavan<br>Vellore Institute of Technology<br>Vellore | Prof C N R Rao<br>Chairman, CPMU<br>JNCASR, Bangalore |

Dr K P Laladhas
St. Stephen's College
Kollam, Kerala

Dr Ramesh Pai
Goa University
Goa

Dr Joseph Fredrick Rosario
St. Joseph's College
Trichy

Dr G Vasundhara
St. Peters College
Kochi, Kerala

Mr D Kandavel
Govt. Arts College
Ariyalur
Tamil Nadu

Dr Naheed Ahmad
Patna University
Patna

Prof P Balaram
Molecular Biophysics Unit
Indian Institute of Science, Bangalore

Prof Rahul Pandit
Department of Physics
Indian Institute of Science
Bangalore

Dr Vijay K Sharma
EOBU, JNCASR
Bangalore

Prof Hemalatha Balaram
MBGU, JNCASR
Bangalore

Prof Raghavan Varadarajan
Molecular Biophysics Unit
Indian Institute of Science
Bangalore

Dr Syed E Hasnain
Director
Centre for DNA Fingerprinting and Diagnostics
Hyderabad.

**4. Project Oriented Chemical Education (POCE)**

This newly introduced programme aims to provide opportunity for bright students of first year B Sc/B Tech/BE to the exciting world of doing science and to become good chemists. It was widely publicised and the response was very good. Ten students are offered scholarship of Rs.4,000/- per month for two summer months and renewable for three consecutive years. These students will undergo intense training by way of listening to faculty lectures and doing laboratory work at the Centre.

**5. Science Education Programme**

**National Science Day**

On the occasion of the National Science Day, science popularisation programme was organised on 17th February 2004 at the Centre. About 140 students and 30 teachers from 12 schools in the city have participated in the programme. Prof C N R Rao delivered a lecture on 'Doing Science', followed by multimedia presentation of excerpts from the CD ROM 'Learning Science' produced by the Centre. After this, students and their teachers visited various laboratories at the Centre and interacted with the Faculty.

# Chapter V

## RESEARCH PROGRAMMES

### 1. Research Areas

There are ongoing research programmes in several frontier, interdisciplinary areas of science and engineering. The main areas of research interest at present are:

- Molecular Modeling of Materials, Monte Carlo and Molecular Dynamics
- Brillouin and Raman Scattering
- Nanoscience, Molecular Charge Density
- Optical, Electronic and Magnetic Phenomena in Organic/Polymeric/Nanoparticle Based Materias and Devices
- Inorganic Framework and Nanoporous Solids, Phosphors and Related Ceramics
- Thin Films by Chemical Vapour Deposition, Nanomaterials, Gas Sensors and Spintronics
- Solid State & Materials Chemisry
- Experimental Condensed Matter Physics, Nanotubes and Semiconductors
- Molecular Dynamics Simulations and Kinetic Theory, Fluid Mechanics at Micro and Nanoscales
- Instability and Transition to Turbulence, Mixing and Vortex Dynamics
- Fluid Mechanics, Aerospace Engineering, Atmospheric Sciences
- Unsteady Aerodynamics of Insect Flight, Entrainment in Free Shear Flows, Geo-fluid Dynamics
- Evolutionary Genetics and Population Ecology
- Chronobiology and Animal Behaviour
- Ecology and Evolution
- Developmental Biology and Evolutionary Theory
- Molecular, Physiological, Evolutionary and Social Aspects of Circadian Rhythms
- Neotectonics and Environmental Geology
- Infectious Diseases
- Chromatin Organization and Transcription Regulation
- Developmental Biology and Genetics
- Human Molecular Genetics
- Protein Engineering, Molecular Enzymology and Parasitology
- Design and Optimization of DNA Vaccines
- Chromatin Remodeling, DNA Repair and Cancer, Cancer Genomics

- *Ab Initio* Theory, Modelling and Simulation of Materials
- Slow Dynamics and Glass Transition in Liquids
- Liquid-Liquid Phase Transition In Supercooled Silicon
- Quantum Many-Body Studies: Molecules to Extended Materials
- Condensed Matter Theory
- Molecular Design and Supramolecular Chemistry
- Mechanisms of Gene Delivery
- Mechanism Of Action Of Hepatotoxins
- Bioinorganic Chemistry

**2. Research Facilities**

The Centre has the following state-of-art facilities in some focused areas in Science and Engineering. The following major equipments were acquired during the year :

Hi-voltage Power Op Amp
Function Generator With Accessories
HPLC Biologic Duoflow Quadtec
SORVALL Evolution RC Refregerated Super Speed Centrifuge
Leica Stereozoom Microscope
N2771a-15 KV 50 Mhz. High Voltage Probe
Heraeus Labfuge 400R General Purpose Centrifuge
Gene Amp PCR System 9700 Gold Plated Silver Block Module
NIS 70 3D Flat Scanner, Fibre Illuminator System
Mossbauer System
Gel Documentation System
Rigaku Model Miniflex + Desktop Diffractometer
Pulse Field Electrophoresis
WinEdt (Text Editor & Shell)
X Win 32 5.4 Floating
Gaussian 03 Binary Code License
CHARMM 30 Programm
Electrophoresis Unit, Power Pack, Semidry Transfer Unit
1500 deg.C Horizontal Tube Furnace
Turbomolecular Drag Pump
Apple Power Book 1.25GHz.
AFM Scanner for Multimode SPM Scan 125umx125um
Double Sidearm Celstir, 50ml, 125ml, 500ml
23/E Source Measure Unit, KPCL 488 IEEEBoard
DMM/Data Acquisition System
NUAIRE -86 deg C Upright Freezer
Gold GeneAmp PCR System 9700
TIPOS Software
LINUX Cluster on V60 Server
Wave Nucleic Acid Fragment Analysis System
Digital Source Meter, Shrouded Unit Test Lead
Hybridite Denaturation Hybridization System
JASCO J-810 CD Spectropolarimeter with Accessories
NEC VT560 High Performance LCD Multimedia Projector
Gel Documentation System

### 3. Sponsored Research

| | | | |
|---|---|---|---|
| 01. | Investigator | : | C N R Rao |
| | Title | : | Materials based on transition metal oxides |
| | Funding Agency | : | DAE (BRNS) |
| | Duration | : | 4 years |
| 02. | Investigator | : | C N R Rao |
| | Title | : | Collaborative projects between JNCASR & DRDO |
| | Funding Agency | : | DRDO |
| | Duration | : | 4 years |
| 03. | Investigator | : | Namita Surolia |
| | Title | : | Fatty acid biosynthesis in Malaria Parasite *Plasmodium falsiparum* as target for developing novel anti- Malarials. |
| | Funding Agency | : | DBT |
| | Duration | : | 3 years |
| 04. | Investigator | : | Maneesha S Inamdar |
| | Title | : | Functional analysis of identified gene trap clones in blood vessel formation studies on embryonic stem cells and chimeric mice. |
| | Funding Agency | : | DST |
| | Duration | : | 3 years |
| 05. | Investigator | : | Hemalatha Balaram |
| | Title | : | *Plasmodium falciparum* hyposanthine guanine Phosphoribosyltransferase and adenylosuccinate synthetic:Targets for antimalarial drug development. |
| | Funding Agency | : | DBT |
| | Duration | : | 3 years |
| 06. | Investigator | : | S Natarajan |
| | Title | : | Investigations on the synthesis, structure and mechanism of formation of materials with framework architectures |
| | Funding Agency | : | DST |
| | Duration | : | 3 years |
| 07. | Investigator | : | Tapas Kumar Kundu |
| | Title | : | Screening of cancers manifesting altered histone Acetyl-transferases (HATs) & (HEACs) function & research for inhibitors of these enzymes in natural products as therapeutic agents |
| | Funding Agency | : | DABUR, DST |
| | Duration | : | 3 years |
| 08. | Investigator | : | S Natarajan |
| | Title | : | Synthesis and structural characterization of new open-framework materials. |
| | Funding Agency | : | CSIR |
| | Duration | : | 3 years |

09. Investigator : Namita Surolia
Title : Design synthesis & evolution of novel anti malaraial agents that target enoyl-ACP reductase (Fabl) of *Plasmodium falciparum*
Funding Agency : Shantha Biotechnics Pvt. Ltd., Hyderabad
Duration : 2 years

10. Investigator : Tapas Kumar Kundu
Title : Role of positive cofactor 4 (PC4) in transcriptional regulation diseases
Funding Agency : DST
Duration : 3 years

11. Investigator : G U Kulkarni
Title : Investigation of properties and phenomena exhibited by nano-materials, nano-fabrication, lithography & related aspects
Funding Agency : DST
Duration : 3 years

12. Investigator : Swapan K Pati
Title : Prediction of new organic chromophore and biochromophore optical limiters
Funding Agency : CSIR
Duration : 3 years

13. Investigator : Rama Govindarajan
Title : Secondary instabilities of viscosity-stratified flows
Funding Agency : DRDO
Duration : 2 years

14. Investigator : Anuranjan Anand
Title : Deafness in India: A network mission towards understanding the genes and mutations and their clinical outcomes
Funding Agency : DBT
Duration : 3 years

15. Investigator : K R Sreenivas
Title : Research infrastructure for high precision measurements in fluid mechanics
Funding Agency : DRDO
Duration : 2 years

16. Investigator : Namita Surolia
Title : Purification of anti-malarial compound from Indian herbs & elicidation of their mode of action in *Plasmodium Falciparum*
Funding Agency : ICMR
Duration : 3 years

17. Investigator : A K Raychoudhuri
Title : Fabrication of two atomic force microscopes
Funding Agency : DST
Duration : 2 years

18. Investigator : Anuranjan Anand
Title : Molecular genetic basis of hot water epilepsy
Funding Agency : ICMR
Duration : 3 years

19. Investigator : K S Narayan
Title : Development of semi-conducting polymer based DAE devices for spatially resolved photocurrent
Funding Agency : DAE
Duration : 3 years

20. Investigator : S Balasubramanian
Title : Computer simulations of aqueous protein solutions: A study on the role of biological water
Funding Agency : DBT
Duration : 3 years

21. Investigator : Swapan K Pati
Title : Electronic transport in molecular nano-systems
Funding Agency : DST
Duration : 3 years

22. Investigator : Ranga Uday Kumar
Title : Evaluation of different molecular approaches to enhance Tat specific immune responses in mice
Funding Agency : DBT
Duration : 2 years

23. Investigator : Srikanth Sastry
Title : Swarnajayanthi Fellowship
Funding Agency : DST
Duration : 5 years

24. Investigator : Srikanth Sastry
Title : Understanding the landscape of glass forming systems
Funding Agency : IFCPAR
Duration : 3 years

25. Investigator : A R Raju
Title : Design, development and demonstration of Hydrogen gas sensor using solid state gas sensor technology based on nanosize semi conducting oxide as sensing element
Funding Agency : ISRO
Duration : 2 years

26. Investigator : K S Narayan
Title : Polymer based photo detectors and development of pixilated line sensors
Funding Agency : MIT
Duration : 2 years

# Chapter VI

## PUBLICATIONS

### 1. Research Publications of Units

#### (i) Chemistry and Physics of Materials Unit

1. Films of metal nanocrystals formed at aqueous-organic interfaces, C.N.R. Rao, G.U. Kulkarni, P.J. Thomas, V.V. Agarwal and P. Saravanan, *J. Phys. Chem.* **B107**, 7391, (2003).
2. Understanding the hydrogen bond in terms of the bond critical point and the geometry of the lone pairs, A. Ranganathan, G.U. Kulkarni and C.N.R. Rao, *J. Phys. Chem.* **A107**, 6073 (2003).
3. Stripes and superconductivity in Cuprates: Is there a connection? N. Kumar and C.N.R. Rao, *Chem. Phys. Chem.* **4**, 439 (2003).
4. Electronic phase separation in rare earth manganates, L. Sudheendra and C.N.R. Rao, *J. Phys. Condens. Matter* **15**, 3029 (2003).
5. Superconducting $NbSe_2$ nanostructures, M. Nath, A.K. Raychaudhuri and C.N.R. Rao, *Chem. Phys. Lett.* **368**, 690 (2003).
6. Hydrogen storage in carbon nanotubes and related materials, G. Gundiah, A. Govindaraj and C.N.R. Rao, *J. Mater. Chem.* **13**, 209 (2003).
7. Ferromagnetic GaMnN nanowires, F.L. Deepak, P.V. Vanitha, A. Govindaraj and C.N.R. Rao, *Chem. Phys. Lett.* **374**, 314 (2003).
8. Inorganic nanotubes, C.N.R. Rao and M. Nath, *Dalton. Trans.* **1** (2003).
9. A solvothermal route to CdS nanocrystals, U.K. Gautam, R. Seshadri and C.N.R. Rao, *Chem. Phys. Lett.*, **375**, 560 (2003).
10. Single-walled carbon nanotube bundles intercalated with semiconductor nanoparticles, M. Nath, P.V. Teredesai, D.V.S. Muthu, A.K. Sood and C.N.R. Rao, *Curr. Sci.*, **85**, 956 (2003).
11. Inorganic nanowires, C.N.R. Rao, F.L. Deepak, G. Gundiah and A. Govindaraj, *Prog. Solid State Chem.* **31**, 5 (2003).
12. Organically templated linear and layered iron sulfates, G. Paul, A. Choudhury and C.N.R. Rao, *Chem. Mater.*, **15**, 1174 (2003).
13. Organically templated vanadyl selenites with layered structures, I. Pasha, A. Choudhury and C.N.R. Rao, *Inorg. Chem.* **42**, 409 (2003).
14. Novel properties of a mixed valent iron compound with the kagome lattice, C.N.R. Rao, G Paul, A choudhury, et al, *Phys. Rev. B.*, **67**, 13, 134425 (2003).
15. Understanding the building up process of 3D open-framework metal phosphates, A. Choudhury and C.N.R. Rao, *Chem. Commun.*, 366 (2003).

16. Aliphatic dicarboxylates with 3D metal organic frameworks possessing hydrophobic channels, R. Vaidhyanathan, S. Natarajan and C.N.R. Rao, *Dalton Trans.*, 1459 (2003).

17. Amine-templated linear vanadium sulfates with different chain structures, G. Paul, A. Choudhury and C.N.R. Rao, *Inorg. Chem.*, **42**, 2004 (2003).

18. Transformation of a 4-membered ring zinc phosphate to a sodalite-related structure, M. Dan and C.N.R. Rao, *Chem. Commun.*, 2212 (2003).

19. Phase separation in metal oxides, C.N.R. Rao, P.V. Vanitha and A.K. Cheetham, *Chem. Euro. J.*, **9**, 828 (2003).

20. A $^{57}$Fe Mossbauer study of charge ordering and phase separation in the rare earth manganates, P.V. Vanitha, R. Nagarajan and C.N.R. Rao, *J. Solid State Chem.*, **174**, 74 (2003).

21. Magnetic, optical and transport properties of GaMnN films, K. Sardar, A.R. Raju and C.N.R. Rao, *Solid State Commun.*, **125**, 55 (2003).

22. Ferroelectric $YMnO_3$ films deposited on n-type Si (111) substrates, S. Parashar, A.R. Raju, C.N.R. Rao and S.B. Kripanidhi, *J. Phys. D (Appl. Phys)*, **36**, 2137 (2003).

23. Electric current-induced first-order effects on the insulator-metal transition and the colossal electroresistance in rare earth manganates, L. Sudheendra and C.N.R. Rao, *J. Appl. Phys.*, **94**, 2767 (2003).

24. An organically templated open-framework cobalt germinate, N.N. Julius, A. Choudhury and C.N.R. Rao, *J. Solid State Chem.*, **170**, 124 (2003).

25. Open-framework cadmium succinates with interpenetrating frameworks formed by tetrahedral $[ClCd_4O_{24}]$ and $[BrCd_4O_{24}]$ clusters, R. Vaidhyanathan, S. Natarajan and C.N.R. Rao, *Cryst. Growth Design*, 3, 47 (2003).

26. An organically templated open-framework cadmium selenite, I. Pasha, A. Choudhury and C.N.R. Rao, *Solid State Sci.*, **5**, 257 (2003).

27. An organically templated three-dimensional open-framework metal selenite with a diamondoid network, D. Udaykumar and C.N.R. Rao, *J. Mater. Chem.*, **13**, 1635 (2003).

28. First organically templated linear metal selenate, I. Pasha, A. Choudhury and C.N.R. Rao, *J. Solid State Chem.*, **174**, 386 (2003).

29. Formation of complex 3-dimensional inorganic open-framework structures from secondary building units, C.N.R. Rao, *Indian J. Chem.*, **42A**, 2163 (2003).

30. Solvothermal synthesis of a layered open-framework cadmium chloro-oxalate, R. Vaidhyanathan, S. Natarajan and C.N.R. Rao, *Euro. J. Inorg. Chem.*, **9**, 1675 (2003).

31. An open framework cobalt oxalate squarate containing a ligated amine, M. Dan and C.N.R. Rao, *Solid State. Sci.*, **5**, 615 (2003).

32. Amine-templated metal squarates, M. Dan, K. Shivashankar, A.K. Cheetham and C.N.R. Rao, *J. Solid State Chem.*, **174**, 60 (2003).

33. Giant anisotropic magnetostriction in $Pr_{0.5}Sr_{0.5}MnO_3$, R. Mahendiran, M.R. Ibarra, C. Marquina, L. Morellon, A. Maignan, B. Raveau, A. Arulraj and C.N.R. Rao, *Appl. Phys. Lett.*, **84**, 242 (2003).

34. Occurrence of re-entrant ferromagnetic transitions in rare earth manganates on cooling the charge-ordered states, A.K. Kundu, P.V. Vanitha and C.N.R. Rao, *Solid State Commun.*, **125**, 41 (2003).

35. Nanocrystals of metals, semiconductors and oxides: Novel synthesis and applications, C.N.R. Rao, G.U. Kulkarni, P.J. Thomas, U.K. Gautam and M.Ghosh, *Curr. Sci*, **85**, 7, 1041 (2003).

36. EXAFS and XPS investigation of Cu/ZnO catalysts and their interaction with Co and methanol, G.U. Kulkarni and C.N.R. Rao, *Topics in Catalysis*, **22**, 183 (2003).

37. Carbothermal synthesis of the nanostructures of $Al_2O_3$ and ZnO, G. Gundiah, F.L. Deepak, A. Govindaraj and C.N.R. Rao, *Topics in Catalysis*, **24**, 137 (2003).

38. Carbon-assisted synthesis of silicon nanowires, G. Gundiah, F.L. Deepak, A. Govindaraj and C.N.R. Rao, *Chem. Phys. Lett.*, **381**, 579 (2003).

39. Synthesis and characterization of magnetic iron sulfide nanowires, M.Nath. A. Choudhuri, A. Kundu and C.N.R. Rao, *Adv. Mater.*, **15**, 2098 (2003).

40. Hydrogel route to nanotubes of metal oxides and sulfates, G. Gundiah, S. Mukhopadhyay, Y.G. Tumkurkar, A. Govindaraj, U. Maitra and C.N.R. Rao, *J. Mater. Chem.*, **13**, 2118 (2003).

41. A strategy for the synthesis of nanocrystal films of metal chalcogenides and oxides by employing the liquid-liquid interface, U.K. Gautam, M. Ghosh and C.N.R. Rao, *Chem. Phys. Lett.*, **381**, 1 (2003).

42. New strategies for the synthesis of t-selenium nanorods and nanowires, U.K. Gautam, M. Nath and C.N.R. Rao, *J. Mater. Chem. (Commun.)* **13**, 2845 (2003).

43. Two-dimensional Au and Au-Gu alloy nanocrystals with (111) orientation embedded in glassy silica, G. De and C.N.R. Rao, *J. Phys. Chem.*, **B107**, 13597 (2003).

44. Novel Iron(III) complexes of tripodal and linear tetradentate bis(phenolate) ligands: Close relevance to intradiol-cleaving catechol dioxygenases, M. Velusamy, M. Palaniandavar, R.S. Gopalan and G.U. Kulkarni, *Inorg. Chem.*, **42**, 8283 (2003).

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85. Defining the mandate of tuberculosis research in a post genomic era, P. Chakhaiyar and S.E. Hasnain, *Medical Principles and Practice*, (in press).

86. Genomics of *Mycobacterium tuberculosis*: Old threats and new trends, N. Ahmed and S.E. Hasnain, *Indian Journal of Medical Research*, (in press).

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## 3. Books/Proceedings authored/edited by Faculty and Hon. Faculty Members

1. M. Alam, R. Govindarajan, O.N. Ramesh and K.R. Sreenivas, *Proceedings of International Symposium on Advances in Fluid Mechanics, JNCASR:* Bangalore, 2003.

2. K.N. Ganeshaiah and R.U. Shaanker, *A Decade of Diversity*, University of Agricultural Sciences: Bangalore, 2003.

3. J. Gopalakrishnan and G.U. Kulkarni (Eds.), *Advances in Chemistry: A Selection of C N R Rao's Publications (1994-2003)*, World Scientific:Singapore, 2003.

4. G.U. Kulkarni, B. Bagchi and J.Gopalakrishnan (Eds.), *Emerging Directions in Chemical Sciences*, Special issue of the Proc. Indian Acad Sci (Chem Sci.), 115, 319-805, 2003.

5. R. Narasimha, J. Srinivasan and S.K. Biswas (Eds.), *Dynamics of Technology: Creation and Diffusion of Skills and Knowledge*, Sage Publications India Pvt Ltd:New Delhi, 2003.

6. G. Rangarajan and M. Ding (Eds.), *Processes with Long Range Correlations: Theory and Applications*, Springer-Verlag:Berlin, 2003.

7. P.A. Mello and N. Kumar, *Quantum Transport in Mesoscopic Systems: Complexity and Statistical Flcutuations*, Oxford University Press: USA, 2004.

8. C.N.R. Rao, A. Muller and A.K. Cheetham (Eds.), *Chemistry of Nanomaterials*, Wiley-VCH:Weinheim, 2004.

9. K.S. Valdiya, *Understanding Earthquakes and Landslides and Preparing for Hazards*, DST, Government of India:New Delhi, (in press).

10. M.K. Chandrshekaran, *Time in the Living World* [A monograph with 81 text figures], Universities Press: Hyderabad. (in press).

# Chapter VII

## AWARDS/DISTINCTIONS

The following faculty and honorary faculty members of the Centre have received various distinctions and awards both at the national and international level in recognition of their significant contributions to the progress of science and technology.

**Awards & Honours**

**Prof C N R Rao**
SOMIYA Award of the International Union of Materials Research Societies (IUMRS), 2004
Life-Time Achievement Award, Indian Chemical Society, 2003
Sarvadhikari Medal, Calcutta University, 2004
Life-Time Achievement Award, Indian Science Congress, 2004

**Prof S Chandrasekaran**
Alumni Award for Excellence in Research in Science, IISc, 2004
Professor Sukh Dev Endowment Lecturer, University of Pune, 2004

**Prof J Gopalakrishnan**
ISCAS Gold Medal for Solid State Chemistry, 2003

**Prof E D Jemmis**
Third World Academy of Sciences Chemistry Prize, 2003
Charles Coulson Lecture at University of Georgia, 2004

**Dr R A Mashelkar**
Honorary Doctorate in Science and Engineering of M S University of Baroda, Vadodara, 2003
Quimpro Award for Quality Evangelist by Quimpro Foundation, Mumbai, 2003
Life Time Achievement Award by Bundelkhand, 2003
Patent – Thermoprecipitating polymer containing enzyme specific ligands, process for the preparation thereof, and use thereof for the separation of enzyme, A A Vaidya, B S Lele, M G Kulkarni, R A Mashelkar (APP No.6,605,714 dt.12.08.2003)

**Prof R Narasimha**
Life Time Contribution Award in Engineering, Indian National Academy of Engineering, 2003

**Prof K S Narayan**
Prof C N R Rao Oration Award, JNCASR, 2003
Visiting Associate Professor – Mat. Sc. and Engg Dept., University of Michigan, 2003.

**Prof Raghavendra Gadagkar**
Swami Pranavananda Saraswathi Award in Environmental Science and Ecology for the year 2002.
Distinguished Visiting Scholar, University of Pretoria, South Africa, July 2003. Keynote Address delivered during the International Beekeeping Workshop and Honey Festival

(APIEXPO) 2003 at Central College Campus, Bangalore University, 14th October 2003.
Platinum Jubilee Lecturer, Indian Science Congress, Chandigarh, 2004.
Dr. J.C. Ray Memorial Oration Award and Foundation Day Lecture, Indian Institute of Chemical Biology, Kolkata, 2004.

**Prof P Rama Rao**
General Medal: The Meghnad Saha Medal, Indian National Science Academy, 2004
Distinguished Life Membership Award, American Society of Materials 2004.

**Prof Santanu Bhattacharya**
Bhagyatara National Award, Panjab University, 2004.
S.S. Bhatnagar Award for Chemical Sciences, CSIR, Government of India, 2003.
National Bioscience Award for Career Development, Department of Biotechnology, Government of India, 2003.

**Prof H Sharat Chandra**
Sir M Visvesaraya Award, Government of Karnataka

**Prof M M Sharma**
Lifetime Achievement Award, Chemical Research Society of India
Honorary Fellowship, Indian Plastics Institute
Honorary Fellowship, Jawaharlal Nehru Centre for Advanced Scientific Research, 2003.

**Prof Srikanth Sastry**
Swarnajaynti Fellowship in Physics, DST, Govt. of India, 2003

Prof K S Valdiya
D Sc (honoris causa) Degree from the Banaras Hindu University, 2003
NSA: J.L. Nehru Birth Centenary Lecture at the Departments of Geology Geophysics, Banaras Hindu University, Varanasi on December 15, 2003.

**Prof M Vijayan**
Jawaharlal Nehru Birth Centenary Award, Indian Science Congress Association, 2003-2004
Padma Shri, 2004
Distinguished Biotechnologist Award of the DBT, 2004.

## FELLOWSHIPS

**Prof B M Deb**
Fellow, Third World Academy of Sciences, Trieste, Italy.

**Dr K N Ganeshaiah**
Fellow, National Academy of Agricultural Sciences, India

**Prof P T Manoharan**
Fellow, Indian National Science Academy, India
Fellow, Indian Academy of Sciences, India

**Prof V Nagaraja**
Fellow, Indian National Science Academy, India

**Prof Seyed E Hasnain**
President, Indian Society of Cell Biology, 2003-2005
Member, International Advisory Board, MEEGID (Molecular Epidemiology and Evolutionary Genetics of Infectious Diseases), France, 1998-
Member, European Society of Human Genetics, 2003

**Prof H Sharat Chandra**
Fellow, Third World Academy of Sciences, Italy

**Prof Sriram Ramaswamy**
Fellow, Indian National Science Academy, India

**Prof M Vijayan**
Fellow, Indian National Science Academy, India
Fellow, Indian Academy of Sciences, Bangalore, India
Fellow, National Academy of Sciences, India, Allahabad, and
Fellow, Third World Academy of Sciences, Trieste, Italy

## EDITORIAL BOARDS

**Prof Anuranjan Anand**
Editor, Journal of Genetics, Indian Academy of Sciences, Bangalore, India

**Prof J Gopalakrishnan**
Member, J. Chemical Sciences, Indian Academy of Sciences, Bangalore, India

Prof K S Narayan
Member, Pramana - Journal of Physics

**Prof R Narasimha**
Chairman, Editorial Board, Indian Journal of History of Science, Indian National Science Academy

## MEMBERSHIPS/APPOINTMENTS

**Prof Amitabh Joshi**
Member, DST constituted Expert Consultative Committee for Evolving Areas for Research and Training in Behavioural/Social Sciences using Mathematical Methods, 2004.

Member, Sectional Committee for Animal/Plant Sciences, Indian Academy of Sciences, Bangalore, 2004.

**Prof C N R Rao**
Chairman, Board of Governors, Indian Institute of Technology, Kanpur.

**Prof S Chandrasekaran**
Member, Advisory Board & Scientific Council, Chemgen Pharma International.
Member, Research Council, National Chemical Laboratory, Pune.
Member, Research Council, Central Leather Research Institute, Chennai.
Member, Research Council, Regional Research Laboratory, Trivandrum.
Member, Council, Indian Association for the Cultivation of Science, Kolkata.
Member, Council, JNCASR, Bangalore.
Secretary, Indian Academy of Sciences, Bangalore.

**Dr R A Mashelkar**
Chairman, Expert Committee, A Comprehensive Examination of Drug Regulatory Issues, including the problem of Spurious Drugs by Government of India.

Member, Committee of Third World Academy of Sciences (TWAS) in Engineering Science and Technologies, 2003.

**Prof R Narasimha**
Chairman, Research Council, National Commission of History of Science

**Prof K S Narayan**
Materials Research Society, 2004 - present
IEEE, 2002-present
TMS, 2002-2003
Materials Research Society of India, 1996-present

**Prof Raghavendra Gadagkar**
Member, Project Advisory Review Committee (PARC), Central Forensic Science Laboratory, Kolkata – Directorate of Forensic Science, Ministry of Home Affairs, Government of India, 2003-2007.

Member, Advisory Committee, Pitambar Pant National Environment Fellowship, Ministry of Environment and Forests, Government of India, 2003

Overseas Co-convener, Social Insect Symposium for 2004, International Congress of Entomology, Brisbane, Australia.

Member, Expert group to advice the Government on matters pertaining to Convention on Biological Diversity (CBD), 2003- present.

Member, Working Committee of the Current Science Association, Bangalore 2004-2006.

Chairman, Research Sub-Committee on Mangroves and Coral Reefs, Ministry of Environment & Forests, Government of India, 2004 –

INSA Council Nominee for the Council of Indian Science Congress Association, 2004-2005.

**Prof Syed E Hasnain**
Council, Indian Academy of Sciences, Bangalore , 2004-2006

Chairman, Sectional Committee for General Biology, Indian Academy of Sciences, Bangalore , 2004.

Sir Dorabji Tata Centre for Research in Tropical Diseases, IISc, Bangalore.

Institute of Immunoheamatology, Mumbai

Mahatma Gandhi National Institute of Research & Social Action, Hyderabad

NII, 1991-93

Vision 2020: Right to Sight Society, Hyderabad, 2002-

**Dr C S Sundar**
Member, Executive Committe of Indian Physics Association, 2004-06

# Chapter -VIII

## FINANCIAL STATEMENTS

| | | |
|---|---|---|
| **NAME** | : | **JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH** |
| **ADDRESS** | : | **JAKKUR POST, BANGALORE - 560 064** |
| **YEAR ENDED** | : | **31ST MARCH 2004** |
| **ASSESSMENT YEAR** | : | **2004-2005** |

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No. 618, 75th Cross, 6th Block,
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**PARTNERS:**
**G.R. Venkatanarayana,** B.Com., F.C.A.
**G.S. Umesh,** B.Com., F.C.A.

# AUDITOR'S REPORT

We have examined the Balance Sheet of JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH, Jakkur Complex, Jakkur, Bangalore - 560 064, as at 31st March 2004 and also the Income & Expenditure Account for the year ended on that date. These financial statements are the responsibility of the institution's Management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with auditing standards generally accepted in India. These Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material mis-statement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit proves a reasonable basis for our opinion.

(a) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for purposes of our audit.

(b) In our opinion, proper books of account, as required by law, have been kept by the institution so far as appears from our examination of such books.

(c) The Balance Sheet and the Income & Expenditure Account referred to in this report is in agreement with the books of account.

(d) In our opinion and to the best of our information and according to the explanations given to us, subject to notes on accounts and accounting policies stated which are not in conformity with Accounting Standards issued by the Institute of Chartered Accountants of India, viz., AS - 9 [Revenue Recognition] & AS - 15 [Accounting for Retirement Benefits in the Financial Statements of Enterprises], the said accounts give a true and fair view.

(i) Insofar as it relates to the Balance Sheet, of the state of affairs of Institution as at 31st March 2004.

(ii) In the case of Income & Expenditure Account, of the excess of Income Over Expenditure for the year ended on the date.

**for M/s. G.R. VENKATANARAYANA**
Chartered Accountants
Sd/-
(G.R. Venkatanarayana)
Partner

Place : Bangalore
Date : 06-10-2004

## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIEN TIFIC RESEARCH

### BALANCE SHEET AS AT 31st MARCH 2004

| Description | Schedule | Current year 2003-04 | Previous year 2002-03 |
|---|---|---|---|
| **LIABILITIES** | | | |
| Capital Fund | 1 | 471042555.66 | 442614491.66 |
| Earmarked and Endowment Funds | 3 | 46970702.41 | 44167368.41 |
| Current Liabilities and Provisions | 7 | 5234673.45 | 9461832.45 |
| Other funds-Cluster Studies | | 39541.00 | 39541.00 |
| Scheme Balances | | 42221206.80 | 28830503.14 |
| **Total** | | **565508679.32** | **525113736.66** |
| **ASSETS** | | | |
| Fixed Assets | 8 | 471042555.66 | 442614491.66 |
| Investments-Endowment Funds | 9 | 46602000.00 | 35902000.00 |
| Investment - others | 10 | 6970000.00 | 21970000.00 |
| Current Assets, Loans,Advances etc. | 11 | 36548712.03 | 20166099.82 |
| Deficit as per Income & Exp. Account ( Rs.4461145.18 - Rs.115733.55 ) | | 4345411.63 | 4461145.18 |
| **Total** | | **565508679.32** | **525113736.66** |

### INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2004

| Description | Schedule | Current year 2003-04 | Previous year 2002-03 |
|---|---|---|---|
| **INCOME** | | | |
| Grants/Subsidies | 13 | 89310690.00 | 90903292.00 |
| Income from Fees/ Subscription etc | 16 | 1788298.70 | 1166437.00 |
| Interest Earned | 17 | 711447.00 | 989567.70 |
| Other Miscellaneous Income | 18 | 143624.00 | 424777.00 |
| **Total** | | **91954059.70** | **93484073.70** |
| **EXPENDITURE** | | | |
| Establishment expenses | 20 | 28121430.00 | 26979515.00 |
| Other adiministrative expenses | 21 | 35288832.15 | 35974779.45 |
| **Total** | | **63410262.15** | **62954294.45** |
| Balance being Excess on Income over Exp. | | 28543797.55 | 30529779.25 |
| **Non-recurring expenditure** | | **28428064.00** | **28999571.00** |
| **Balance being Surplus carried forward** | | **115733.55** | **1530208.25** |
| Significant accounting policies (enclosed) | 24 | | |

**for M/s.G.R.Venkatanarayana**
Chartered Accountants

Sd/-
**(G.R.Venkatanarayana)**
Partner

Sd/-
**R.S.Gururaj**
Accounts Officer

Sd/-
**Prof. M.R.S.Rao**
President

Place : Bangalore
Date : 06-10-2004

## Accounting Policies and Notes on the Accounts for the year 2003-04

1. The fixed assets are stated at cost. The Centre has identified depreciation on fixed assets, and they are created out of Grant in Aid funds. Hence the depreciation has been shown in the statement of affairs under Capital Fund and also under Fixed Assets respectively.
2. The Gratuity & leave encashment to the staff members is accounted as and when it is paid.
3. Investments of the Centre are stated at cost. The interest on investment is accounted as and when they are received from the concerned banks and financial institutions.
4. The foreign currency transactions are translated at the rates prevailing on the date of transaction.
5. Previous years figures have been regrouped and reclassified to read in conformity with the current year's figures.
6. The Centre has put into operation a system whereby the accounting standards with respect to the above are brought in conformity with the mandatory accounting standards recommended by the institute of Chartered Accountants of India.

For **M/s G.R.Venkatanarayana**
Chartered Accountants

Sd/-
**R.S.Gururaj**
Accounts Officer

Sd/-
**Prof. M.R.S.Rao**
President

Sd/-
**G.R.Venkatanarayana**
Partner

Place : Bangalore
Date : 06-10-2004

# JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
## CPF AND GRATUITY FUND STATEMENT AS ON 31.03.2004

| Particulars | Rs. | Rs. | Particulars | Rs. | Rs. |
|---|---|---|---|---|---|
| **SUBSCRIPTION** | | | | | |
| Opening Balance | **6740081.00** | | Canara Bank | 6618000.00 | |
| | | | ICICI | 100000.00 | |
| Subscriptions during the year | 2227534.00 | | IDBI Flexi bonds | 3400000.00 | |
| | | | KBJNL | 200000.00 | |
| Interest on subscriptions | 576493.00 | | | | |
| | | | | | 10318000.00 |
| **Total** | **9544108.00** | | | | |
| | | | Cash at Bank | | |
| Less withdrawals | -1091584.00 | | SB A/C No.17513 | | |
| | | 8452524.00 | Canara Bank,IISc branch | | 3805581.69 |
| Less IT | | -22894.00 | | | |
| **Total** | | **8429630.00** | | | |
| **CONTRIBUTION** | | | | | |
| | | | Accrued interest on investments | | 540282.04 |
| Opening balance | 4593992.00 | | | | |
| Contribution during the year | 573416.00 | | | | |
| Interest on total contributions | 343468.00 | | Deficit on interest payment 2003-04 | | 690719.27 |
| | | **5510876.00** | | | |
| Gratuity fund | | 1414077.00 | | | |
| **Total** | | **15354583.00** | **Total** | | **15354583.00** |

**for M/S G.R.VENKATANARAYANA**
CHARTERED ACCOUNTANTS

Sd/-
**R.S.GURURAJ**
Accounts officer

Sd/-
**PROF.M.R.S.RAO**
PRESIDENT

Sd/-
**(G.R.VENKATANARAYANA)**
PARTNER

Place : Bangalore
Date : 06-10-2004

# JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

## Schedule forming part of the Balance Sheet as at 31st March 2004

| | Description | 31.03.2004 | 31.03.2003 |
|---|---|---|---|
| | **Schedule 1 Corpus/Capital Fund** | | |
| | Balance as at the beginning of the year | 395866452.66 | 366866881.66 |
| | Carbon Nano Materials | 34182430.00 | 34182430.00 |
| | Physics and Chemistry of Materials | 9878095.00 | 9878095.00 |
| | Cluster Studies | 2687514.00 | 2687514.00 |
| | | 442614491.66 | 413614920.66 |
| | Less - Depreciation for the previous years | -102127871.00 | |
| | | **340486620.66** | |
| | **Addition to Fixed Assets during 2003-04** | 28428064.00 | 28999571.00 |
| | | **368914684.66** | |
| | Less - Depreciation for the current year | -14398390.59 | |
| | | **354516294.07** | |
| | Depreciation Reserve per contra | 116526261.59 | |
| | **TOTAL** | **471042555.66** | **442614491.66** |
| | **Schedule 3 Earmarked / Endowment Funds** | | |
| 1. | Opening Balance of the Funds | 44167368.41 | 39646693.42 |
| 2. | Addition to Funds/Donations/Grants/Royalties | 1580313.00 | 2166276.84 |
| 3. | Addition to Funds-Income from Investments made | 2984749.00 | 3266808.15 |
| 4. | Addition to funds - other funds | 91000.00 | 1349.00 |
| 5. | Funds-utilisation/Expenditure incurred | -1852728.00 | -913759.00 |
| | **TOTAL** | **46970702.41** | **44167368.41** |
| | **Schedule 7 Current liabilities and provisions** | | |
| 1. | Sundry Creditors EMD | 524221.00 | 536221.00 |
| 2. | Sundry Creditors CMD | 91185.00 | 80685.00 |
| 3. | Sundry Creditors | 4767596.45 | 9055576.45 |
| 4. | Other Current Liabilities | -148329.00 | -210650.00 |
| | **TOTAL** | **5234673.45** | **9461832.45** |

Sd/-
**R.S.Gururaj**
Accounts Officer

## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

### Schedule forming part of the Balance Sheet as at 31st March 2004

| | Description | 31.03.2004 | 31.03.2003 |
|---|---|---|---|
| | **Schedule 8 Fixed Assets** | | |
| 1 | Land - Free Hold | 17384101.00 | 12636515.00 |
| 2 | Buildings | 79658165.26 | 79658165.26 |
| 3 | Plant/Machinery/Equipment | 131264649.47 | 126116759.47 |
| 4 | Vehicles | 1694263.10 | 1694263.10 |
| 5 | Furniture and fixtures | 12256100.87 | 9767460.87 |
| 6 | Office equipment | 4819665.63 | 4464082.63 |
| 7 | Computer/peripherals | 9950033.00 | 8170138.00 |
| 8 | Electrical installations | 1773992.00 | 1520115.00 |
| 9 | Library Books | 6936743.21 | 6468233.21 |
| 10 | Library Journals | 34383709.80 | 29537229.80 |
| 11 | Tubewells and water supply | 176359.00 | 94039.00 |
| 12 | Infrastructure facility | 31827870.32 | 31364201.32 |
| 13 | Hostel Building | 15570835.00 | 15570835.00 |
| 14 | New Lab Building - AMRL | 25377072.00 | 25377072.00 |
| 15 | Animal House | 5425605.00 | 5425605.00 |
| 16 | Staff Housing | 4118031.00 | 4118031.00 |
| 17 | ETU Building | 2048814.00 | 1754632.00 |
| 18 | The College, Biology block, Extn.AMRL etc. | 12335090.00 | 4835658.00 |
| 19 | Equipments Carbon & Nano Materials | 34182430.00 | 34182430.00 |
| 20 | Equipments Physics and Chemistry of Materials | 9878095.00 | 9878095.00 |
| 21 | Equipments Cluster Studies | 2687514.00 | 2687514.00 |
| 22 | Equipments Advance Technology Lab | 20202562.00 | 20202562.00 |
| 23 | Equipment Magnet | 7090855.00 | 7090855.00 |
| | **TOTAL** | **471042555.66** | **442614491.66** |
| | **Less** - depreciation for the previous years | **-102127871.00** | |
| | **Less** - depreciation for the current year | **-14398390.59** | |
| | Written down value of the assets as on 31.03.2004 | **354516294.07** | |
| | **Add** - depreciation reserve per contra | **116526261.59** | |
| | **TOTAL** | **471042555.66** | |

Sd/-
**R.S. Gururaj**
Accounts Officer

## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

### Schedule forming part of the Balance Sheet as at 31st March 2004

| | Description | | 31.03.2004 | 31.03.2003 |
|---|---|---|---|---|
| | **Schedule 9 Investments - Earmarked/Endowment Funds** | | | |
| 1. | ICICI | | 800000.00 | 2300000.00 |
| 2. | IDBI | | 6200000.00 | 6200000.00 |
| 3. | HDFC | | 12050000.00 | 7050000.00 |
| 4. | CRB CAPITAL | | 12000.00 | 12000.00 |
| 5. | CANARA BANK | | 18540000.00 | 18540000.00 |
| 6. | UTI | | | 1200000.00 |
| 7. | IDBI FLEXI BONDS | | | 600000.00 |
| 8. | STOCK HOLDING CORPORATION OF INDIA ( RBI ) | | 9000000.00 | |
| | **TOTAL** | | **46602000.00** | **35902000.00** |
| | **Schedule 10 Investments - Others** | | | |
| 1. | Fixed deposits with banks - Canara Bank | | | 10000000.00 |
| 2. | Fixed deposits with banks - Canara Bank ( Schemes ) | | 6970000.00 | 6970000.00 |
| 3. | Fixed deposits with banks - SBI ( Schemes ) | | | 5000000.00 |
| | **TOTAL** | | **6970000.00** | **21970000.00** |
| | **Schedule 11 Current Assets, Loans, Advances etc.,** | | | |
| 1. | Inventories-Cement drawn from IISc | | | 294182.00 |
| 2. | Other advances | | 646142.00 | 69601.00 |
| 3. | Cash balance in hand - | Centre | 115926.00 | 70612.00 |
| | | Schemes | 79972.00 | 73967.00 |
| 4. | Cash at bank | | | |
| | | Centre - Canara Bank | 5832078.13 | 9980896.43 |
| | | Schemes - Canara Bank | 28379288.79 | 5688914.54 |
| | | Schemes - State Bank of India | 1261112.11 | 3683178.70 |
| 5. | Advances to staff | | 205961.00 | 128215.00 |
| 6. | Contingent Advances | | 28232.00 | 137666.15 |
| 7. | Other advances - Schemes | | | 38867.00 |
| | **TOTAL** | | **36548712.03** | **20166099.82** |

Sd/-
**R.S.Gururaj**
Accounts Officer

## JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

### Schedule forming part of the Income & Expenditure for the period 01-04-2003 to 31-03-2004

| | Description | 31.03.2004 | 31.03.2003 |
|---|---|---|---|
| | **Schedule 13 Grants / subsidies** | | |
| 1. | Grants - DST | 85000000.00 | 87500000.00 |
| 2. | Grants - Discussion meetings/Seminars | 4263690.00 | 2974558.00 |
| 3. | Grants - Travel Grants | 47000.00 | 428734.00 |
| | TOTAL | **89310690.00** | **90903292.00** |
| | **Schedule 16 Income from other sources** | | |
| 1. | Income from fee, subscriptions etc. | 1788298.70 | 1166437.00 |
| | TOTAL | **1788298.70** | **1166437.00** |
| | **Schedule 17 Interest earned** | | |
| 1. | From Term deposits | 686878.00 | 233733.00 |
| 2. | From SB accounts with nationalised banks | 24569.00 | 37262.00 |
| 3. | From SB accounts and Deposits - Schemes | | 718572.70 |
| | TOTAL | **711447.00** | **989567.70** |
| | **Schedule 18 Other Income** | | |
| 1. | Other miscellaneous Income | 143624.00 | 424777.00 |
| | TOTAL | 143624.00 | 424777.00 |

Sd/-
**R.S.Gururaj**
Accounts Officer

# JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

## Schedule forming part of the Income & Expenditure for the period 01-04-2003 to 31-03-2004

| | Description | 31.03.2004 | 31.03.2003 |
|---|---|---|---|
| | **Schedule 20 Establishment expenses** | | |
| 1. | Salaries | 20939261.00 | 19998776.00 |
| 2. | Wages | 5294394.00 | 4014696.00 |
| 3. | Allowances | 886692.00 | 777138.00 |
| 4. | Bonus | 153776.00 | 149049.00 |
| 5. | Contribution to CPF | 746191.00 | 1073814.00 |
| 6. | Other expenditure | 101116.00 | 966042.00 |
| | TOTAL | **28121430.00** | **26979515.00** |
| | **Schedule 21 Other Administrative expenses** | | |
| 1. | Electricity & Power | 7752693.00 | 7098135.00 |
| 2. | Water charges | 2038867.00 | 1729776.00 |
| 3. | Insurance | 245955.00 | 177968.00 |
| 4. | Repairs & maintenance | 2743726.00 | 3572801.00 |
| 5. | Rents,rates & taxes | 197885.00 | 36341.00 |
| 6. | Vehicles running & maintenance | 1914024.00 | 1747955.00 |
| 7. | Postage, telephone & communication | 3124861.50 | 2938402.00 |
| 8. | Printing & stationery | 1552284.00 | 1616907.00 |
| 9. | Travelling and conveyance | 1104873.00 | 1927565.00 |
| 10. | Expenses on Seminars/workshops/ discussion meetings | 4014172.50 | 3268211.00 |
| 11. | Subscriptions | 99691.00 | 14764.00 |
| 12. | Fees | 117029.00 | 150835.00 |
| 13. | Professional charges | 741412.00 | 613136.00 |
| 14. | Canteen subsidy | 96274.00 | 251465.00 |
| 15. | Freight & Forwarding | 54704.00 | 93107.00 |
| 16. | Laboratory Consumables | 6495959.15 | 8321125.00 |
| 17. | Advertisement & Publicity | 1617099.00 | 1327688.00 |
| 18. | Other miscellaneous expenses | 1355573.00 | 1066998.45 |
| 19. | Audit Fees | 21750.00 | 21600.00 |
| | TOTAL | **35288832.15** | **35974779.45** |

Sd/-
**R.S.Gururaj**
Accounts Officer


AMRL