Annual Report 2012-13

Jawaharlal Nehru Centre For Advanced Scientific Research

Jakkur, Bangalore – 560 064
www.jncasr.ac.in

Linus Pauling Lecture : "*The antimicrobial defense of Drosophila : A paradigm for innate immunity from liestohumans*", speaker : Prof. Jules Hoffmann (Nobel Laureate), Institute of Molecular and Cellular Biology, University of Strasbourg, France, 12th October 2012

5th Bangalore Nano Award to Prof. G.U. Kulkarni, Chemistry & Physics of Materials Unit, 5-7 December 2012.

Atomic Layer Deposition System (ALD), TFS 200 installed at Sheikh Saqr Laboratory at International Centre for Materials Science.

Merck Millipore "India Innovation Award 2012" to Prof. Tapas Kumar Kundu, Transcription and Disease Laboratory, Molecular Biology & Genetic Unit.

ISRO Satish Dhawan Lecture : "*Science for Musical Excellence of the Mridangam*", Speakers : Vidhwan Umayalpuram Sivaraman & Dr. T. Ramasami, Secretary, DST, 16th October 2012.

Hindi translation of 'Chemistry Today' published and marketed by M/s Sastha Sahitya Mandal, New Delhi.

Special Lecture : "*Recent trends in neurosurgery*", speaker : Dr. D.V. Rajakumar, Consultant and Surgeon, Fortis Hospital, Bangalore, 11th April 2012.

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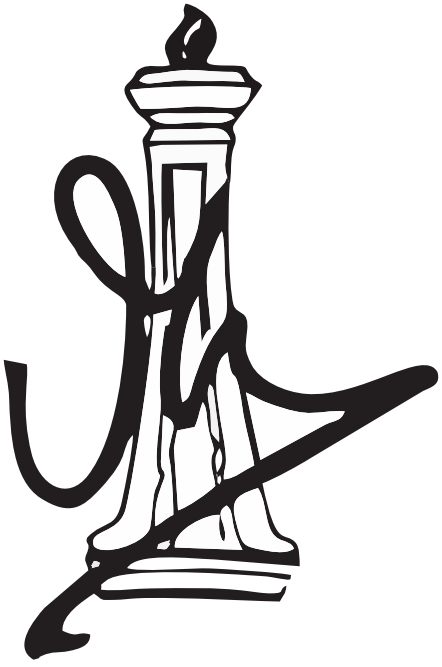

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

(A Deemed to be University)

Jakkur, Bangalore – 560 064
Website: http://www.jncasr.ac.in

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THE CENTRE

Foreword

I have great pleasure in presenting the Twenty Fourth Annual Report for the year 2012-13.

The Centre has been emerging as one of the leading institutions in the country for higher learning and research in frontier areas of science and engineering. The Centre has also been recognized as a Deemed to be University.

There is a steady increase in the number of research students in the Centre pursuing various academic programmes. The present student strength is 273. Forty two students joined the Centre during August 2012 admissions including seven students who joined during mid-year admission in January 2013. Sixteen students were awarded Ph D degrees, four with M S (Materials Science), seven with M S (Eng.), three with M S in Biological Sciences and one student was awarded M S in Chemical Sciences. In order to provide opportunities to teachers and others to obtain training and for carrying out science education projects, this Centre is offering a postgraduate diploma programme in science education. The academic, research, fellowship and extension programmes have been progressing as envisaged. The publication record is growing steadily. The faculty members have made significant scientific contributions. Prof. CNR Rao received the prestigious 2012 Award for International Cooperation by The Chinese Academy of Sciences. It is also a matter of great honour that Prof. Roddam Narasimha has been awarded the *Padma Vibhusan*, one of the most prestigious civilian awards of the country. Awards like *India Innovation Award* from Merck Millipore company to Prof. Tapas Kumar Kundu and his research team, *India Citation Award* 2012 from Thomson Reuters to Prof. Umesh Waghmare, *CRSI Bronze Medal* to Dr. Tapas Maji are the recognition earned by our faculty recently for their outstanding work in their respective fields. Adding a new dimension, the Federation of Indian Publishers have been given the *Awards for Excellence in Publishing* to the Kannada Book '*Nanoprapancha*' authored by Prof. C.N.R. Rao and translated by Mrs. Indumati Rao.

The continuous recognition of our faculty members with several honours has reflected our standing within academic peers.

This year significant progress has been made in all spheres of academic activities at the Centre. A series of programmes were organized by Education Technology Unit (ETU) and Hall of Science toward the promotion of science education.

The C.N.R. Rao Hall of Science and Education Technology Unit has continued conducting the highly popular Teachers/students programs/workshops for students and teachers. In the POCE program for the year 2012, multimedia CD-ROM `NANOWORLD' was presented and a quiz was conducted from the CD-ROM `Understanding Chemistry' for the students followed by a visit to the `Chemistry of Materials Exposition' and Prof. C.N.R. Rao Archives. The book titled "Challenges and Opportunities in Science and Technology (Approach to an Action Plan)" was made ready by ETU for the Science Advisory Council to the Prime Minister. Outstanding Science Teacher Prize function and Lecture Program was organized to recognize outstanding science teachers in the country. Three-day Special Teacher Training Lecture Program was organised in Physics, Chemistry and Biology for PU teachers for which teachers from various Pre-University Colleges were deputed by The P.U. Board, Govt. of Karnataka.

During the financial year, 21 patent applications (Indian Provisional Application: 7, Indian Complete Application: 1, International Patent Application under PCT: 6, USA: 5, Europe: 1, China: 1) were filed and 4 US patents were granted.

The Centre maintains its vibrant academic activities through conferences, seminars, colloquia and discussion meetings.

The infrastructure is being constantly upgraded to meet the academic requirements and for scientific and student activities. All these developments would not have been possible without the continuous support from the Department of Science and Technology.

M R S RAO
President

INTRODUCTION

The Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, a premier research institute in the country, was established in the year 1989, the birth centenary year of Pandit Jawaharlal Nehru, by the Department of Science and Technology. The objectives of the institute shall be to pursue and promote scientific research and training at the highest level in the frontier and interdisciplinary areas of science and engineering. The number of publications in international journals of repute and the filing of patents are steadily increasing year by year. The Centre, which is just twenty four years old, is creating news regularly in the scientific world with its breakthrough discoveries. The Centre has research collaborations with several national and international institutions. In recognition of the achievements of the Centre, the Ministry of Human Resource Development (GOI) has accorded the status of Deemed University, to enable the Centre to train quality manpower. The faculty members of the Centre have received national and international recognitions. Several faculty members of the Centre are Fellows of National and International science and engineering academies.

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 and Chairman of the Scientific Advisory Council to the Prime Minister. Prof V Krishnan, who succeeded him, served as its President from 2000 to 2003. Prof M R S Rao is presently the President of the Centre.

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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.

***

PROGRESS

The Centre has just completed 24 years encompassing several memorable and exciting moments. Following are the research units: 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 International Centre for Materials Science, New Chemistry Unit, and new Unit/Centre like the Thematic Unit of Excellence in Computational Materials Science is the newer in the lot. The new Nanoscience Centre is equipped with the state of the art facilities for advanced research in materials science.

The Centre is equipped with a good Library, an excellent computer support facility, Lecture Halls, a Chemical Education Laboratory, Conference and seminar halls, Faculty Offices and the Administrative Office. A seminar hall, a well-furnished accommodation for academic visitors and a Visitor House are also located at IISc campus.

During the year, forty two students joined the Centre during August 2012 admissions including seven students who joined during mid-year admission in January 2013. Sixteen students were awarded Ph D degrees, four with M S (Materials Science), seven with M S (Eng.), three with M S in Biological Sciences and one student was awarded M S in Chemical Sciences. Currently about 273 scholars are pursuing their research career. The research and training at the Centre has led to the award of 150 Ph D degrees, 41 M S (Engg.), 3 M S (research), 47 M S(of Int Ph.D) and 1 M Sc (by research) so far. The Centre has emerged as a place for interdisciplinary research, with effective interactions among scientists with backgrounds in biology, chemistry, engineering and physics. The JNC community has been working not only in pursuit of research, but also on dissemination of science-related activities reaching out to the common man.

Prof. CNR Rao received prestigious 2012 Award for International Cooperation by The Chinese Academy of Sciences. It is also a matter of great honour that Prof. Roddam Narasimha who has been awarded the Padma Vibhusan, one of the most prestigious civilian awards of the country. Faculty members have received several prestigious awards in their field like India Innovation Award from Merck Millipore company and Ranbaxy Research Award to Prof. Tapas Kumar Kundu, India Citation Award 2012 from Thomson Reuters to Prof. Umesh Waghmare, CRSI Bronze Medal to Dr. Tapas Kumar Maji, Bangalore National Nano Award to Prof. G.U. Kulkarni, Dr. Raja Ramanna Science and Technology Award for Science and Education from Karnataka State Council for Science & Technology - 2013 to Prof. S.M. Shivaprasad, TWAS Prize in Chemistry, 2012 to Prof. Swapan Kumar Pati, National Bioscience Award for Career Development 2012 to Prof. Kaustav Sanyal, and MRSI Medal, 2013 to Dr. Subi J. George. There are several prestigious fellowships which have been awarded to faculty members, such as Einstein Professor of Chinese Academy of Sciences 2012, Erudite Visiting Professorship from Mahatma Gandhi University, Kottayam and Academy Professor, Academy of Scientific & Innovative Research 2013 to Prof. C.N.R. Rao; Prof. P. Rama Rao has received Fellowship of National Academy of Engineering, USA; Honorary Visiting Professorship of Department of Biochemistry, I.I.Sc to Prof. M.R.S. Rao; Hon. Distinguished Professorship of ISRO and Academy Professor of Academy of Scientific and Innovative Research to Prof. Roddam Narasimha; Prof. K.B. Sinha elected as Emeritus Scientist of Indian Statistical Institute, Kolkata; Prof. Shobhana Narasimhan received Indo-Australia Senior Scientist Visiting Fellowship for the year 2012-2013 by INSA; Visiting Professorship Award (2013), by Yukawa Institute for Theoretical Physics, Kyoto University, Japan to Prof. Meheboob Alam; Sheikh Saqr Senior Fellow, 2012 to Prof. G.U. Kulkarni, DST J C Bose Fellowships to Prof. Swapan Kumar Pati and Prof. Umesh Waghamare; TWAS Young Affiliateship, 2012-2017 and Sheikh Saqr Fellow, 2012 to Prof. Tapas Kumar Maji; 2012-2013 Fulbright-Nehru fellowship for senior researchers to Prof. Ganesh Subramanian; DBT Wellcome Trust Fellowship to Dr. Ravi Manjithaya.

Several Ph.D. students have received awards and Best Poster prizes at national and international fora as a recognition to their contributions to science.

The Faculty members of the Centre have published around 300 scientific papers in reputed international journals during the year 2012-13, some of the journals are having high impact factor.

Many patent applications were filed for new inventions. Details are provided in a separate section on “Intellectual Property”.

The interactions with academic institutions and universities globally have continued and the Centre is expanding

its formal ties in respect of collaborative research, exchange of graduate students and consultancy projects.

Honorary Faculty Members of the Centre have continued to play an important role in guiding academic and extension activities of the Centre.

Summer Research Fellowships, Project Oriented Chemical Education Programme, Project Oriented Biological Education Programme, Visiting Fellowships, Extension Programmes and Academic Exchange Programmes have attracted wide attention and have been highly successful.

For the Summer Research Fellowships programme, 73 students were selected and offered the fellowships this year. For POCE 2013-15, 10 meritorious students were offered the fellowship. Nine students of POCE-2010-12 were awarded Diploma in Chemistry. Under POBE 2013-15, 10 candidates joined the programme. Eight students of POBE 2010-12 batch received their Diploma in Biology certificates this summer on successful completion of their 3 year project training. Eight candidates have been selected to the Visiting Fellowships Programme 2012-13 under the Physical Sciences category and two under the Biological Sciences category. JNCASR-CICS Fellowship were awarded to 8 candidates from Nigeria, Yemen, Bangladesh and Armenia.

Since the beginning of the financial year 2012-13, ten Discussion Meetings, twenty four International Conferences, Workshops, and Schools were supported, either wholly or partially by the Centre. Around ninety nine seminars were held including nine Endowment Lectures and three General Lectures delivered by eminent scientists.

HIGHLIGHTS OF RESEARCH AND OTHER ACTIVITIES

Research

Chemistry and Physics of Materials Unit (CPMU)

Clay-RGO hybrids have been prepared and their application in simultaneous adsorption of protein and DNA has been investigated. It was found that the water dispersible aminoclay is very efficient in dispersing the reduced grapheme oxide(RGO) in water at higher concentration. Hierarchical metal structures have been synthesized by a modified approach to nanoimprint lithography. A multi-state memory device has been realized based on electrically activated Pd oxide. Work had been undertaken towards understanding the formation of a) low carrier concentration InN thin films and its dependence on the kinetics of growth and surface modifications, and b) atomistic details of the wurtzite GaN nanorod and nanotubes formation on Al_2O_3 substrates. The molecular features which govern the mechanism of supramolecular polymerization had been identified and delineated. It was discovered that density functional theory and empirical potential based MD simulations of liquid dimethyl carbonate, an environmentally benign solvent have shown clustering of conformers with high dipole moment. Two new families of multiferroic materials were investigated, namely RMO_3 (M = Cr and Fe) and $YMM'O_3$ (M and M' are two different transition metals such as Cr, Mn and Fe). The Molecular Electronics lab carried out studies of photo-physical properties of semiconducting polymers, fabrication and device physics of organic solar cells and polymer based field effect transistors. Raman studies of RMO_3 (M = Cr, Fe, Mn) were carried out to understand the microscopic origin of multiferroicity in these compounds. Microscopic origin of gas adsorption in metal organic frameworks was investigated using Raman spectroscopy. First demonstration of SERS as a tool for determining small molecule binding to therapeutic proteins was demonstrated in the case of Felodipine and Aurora A.

Education Technology Unit (ETU)

The Education Technology Unit has been actively involved in the concept, development and production of multimedia CD-ROMs and books especially for school students and teachers in various disciplines of science, including resources in vernacular Indian languages. The C.N.R. Rao Hall of Science and Education Technology Unit has continued conducting the highly popular Teachers/students programs/workshops for students and teachers. These workshops/programs are conducted in different subjects like Physics, Chemistry and Biology. The Book `*Rasaayanshaastrada Arivu*' authored by Prof. C.N.R. Rao was translated by Mrs. Indumati Rao and produced by ETU for Karnataka Rajya Vijnana Parishath (KRVP).

In the POCE program for the year 2012, ETU presented the multimedia CD-ROM `*NANOWORLD*' and a quiz was conducted from the CD-ROM `*Understanding Chemistry*' for the students. A Webpage for the Hall of Science was a project taken up jointly by ETU & Complab.

The CNR Rao Hall of Science and ETU organized the Outstanding Science Teacher Prize function and Lecture Program on June 29, 2012. The awardees for the year 2011 are Shri. S.V. Burli and Smt. M. S. Rekha. A Special Teacher Training Three-day Lecture Program in Physics, Chemistry and Biology for PU teachers was organised.

ETU is engaged in producing a book for the Science Advisory Council to the Prime Minister titled `*Science in India (2004-2013)*'.

Engineering Mechanics Unit (EMU)

Prof. Roddam Narasimha's group: in the area of Aerospace and Atmospheric Fluid Mechanics, the concept underlying a novel design of optimal wing planforms for turboprop aircraft, determined through special algorithms developed at JNC, have now been confirmed by wind tunnel tests conducted by NAL at IISc. Comprehensive simulations of a free shear layer in a vortex gas have been completed. It is shown that the vortex gas evolves to a stationary state characterizing a variant of Lundgren-Pointin equilibrium. In atmospheric fluid dynamics, entrainment measurements have been made in a transient diabatic jet for the first time.

In *Prof. K.R. Sreenivas's group*, results from the study of nocturnal atmospheric boundary layer has culminated in the publication of a set of three papers, two in Journal of Atmospheric Sciences and one in Quarterly Journal of Royal Meteorological Society. In this study an error was indentified in the flux-emissivity model for radiation widely used by many researchers in the atmospheric community. The error was responsible for spurious cooling

reported in many studies, and its effect extends all the way up to 1 km in the atmospheric boundary layer.

Prof. Meheboob Alam's research group was involved in experimental works on vertically vibrated binary granular mixtures which lead to exciting new results. A variety of phase-coexisting patterns was uncovered, characterized by the coexistence of patterns having different spatial and temporal symmetries.

Research group led by *Prof. Ganesh Subramanian* worked on concentration fluctuations in bacterial suspensions; bacterial suspension rheology; particle-level simulation; Vortex Rings Oscillations; sonic transition in viscoelastic flows; role of micro-scale inertia in multiphase heat-transfer.

Evolutionary & Organismal Biology Unit (EOBU)

The faculty of EOBU continued their research in the broad areas of animal behaviour /phylogeography, chronobiology, evolutionary genetics, neurogenetics, and population dynamics. Research in this unit had been in the areas of (a) biogeography of large mammals in the Western Ghats, (b) social organization in Asian elephants, (c) behavioural, neurogenetic and molecular bases of *Drosophila* circadian clocks, (d) evolution of adaptations to crowding, especially the interplay of food deprivation and waste buildup, (e) fruitflies as a model system for neurodegenerative disorders, (f) behavioural neurogenetics, (g) circadian entrainment by temperature cycles, (h) fruitfly metapopulation dynamics and stability.

Molecular Biology and Genetics Unit (MBGU)

MBGU currently has several research and training avenues in broad areas of biological sciences. Research in nine of its laboratories spans diverse areas of modern biology with emphasis on biomedicine.

Autophagy Laboratory studied autophagy and autophagy-related pathways. A new live cell assay have been designed to kinetically monitory general and selective autophagy pathways and have miniaturized it to suit the high throughput format.

Molecular Mycology Laboratory studied structure-function analysis of centromeres of several pathogenic yeasts: *Candida albicans*, *Candida dubliniensis*, *Candida tropicalis* and *Cryptococcus neoformans*. They observed that centromere DNA sequences are rapidly evolving when *C. albicans* and *C. dubliniensis* orthologous chromosomes were analyzed.

Transcription and Disease Laboratory aimed to understand the different aspects of chromatin functional dynamics which are responsible for the gene regulation and its link to cellular physiology and pathobiology. Two different diseases are being investigated in this context, namely cancer (oral cancer and breast cancer) and AIDS. It was found that human chromatin associated protein PC4, gets acetylated *in vivo* and possibly enriched in the transcriptionally active chromatin.

In *Vascular Biology Laboratory*, ***o***ver the last year, significant progress was made in understanding mechanisms that maintain stem cell potency. The endosomal protein Asrij was identified as being essential for maintaining the balance between the pluripotent stem cell state and the differentiated state. Further it was showed that Asrij has a conserved function in maintaining stemness. A transcriptome analysis of rudhira mutants was performed and several key pathways were identified through which rudhira mediates its function.

Human Molecular Genetics Laboratory, in a study of over 750 families with non-syndromic hearing loss, has examined several deafness-causing genes (Cx26, Cx30, TMPRSS3, TMC1, HAR, CDH23, PDS and TMIE) and identified a large number of pathogenic mutations in these genes. This work has substantially extended allelic heterogeneity at these genes and provided a collection of mutant alleles for potential use in cell biological, biochemical and structure-function correlation studies. Another significant contribution made by the lab is the identification of a locus, DFNA59 for prelingual, profound, sensorineural hearing loss at chromosome 11p14.2-q12.3.

Research in one of the *Molecular Parasitology Laboratories* headed by Prof. Hemalatha Balaram has focused on understanding metabolism in the malaria parasite *Plasmodium falciparum*. Towards this end the enzymes involved in purine nucleotide metabolism in the parasite had been studied. Comparative structure-function analysis is also being carried out on the homologues from humans and archaea. Adenylosucinate synthetase from

M. jannaschii has been characterized biochemically. Another Parasitology lab in the unit headed by Prof. Namita Surolia is focusing its efforts on the role of *Plasmodium* kinases in host-pathogen interactions. This group has been focusing on understanding the molecular mechanism underlying the pathogenesis of cerebral malaria in Indian patients through a "Systems -Biology" approach. The group is also trying to decipher canonical and non-canonical intracellular trafficking pathways in Plasmodium falciparum, in the process they have found some novel proteins responsible for the development of the parasite. The group is also studying proteins involved in host-pathogen interactions.

In *Chromatin Biology Laboratory*, work in the chromatin TP2 is acetylated in vivo as detected by anti-acetylated lysine antibodies and mass spectrometric analysis. Recombinant TP2 is acetylated in vitro by p300 and PCAF. p300 acetylates TP2 in its C-terminal domain which is highly basic in nature possessing chromatin condensing properties. Molecular Parasitology Laboratory has focused on understanding metabolism in the malaria parasite Plasmodium falciparum. Towards this end the enzymes involved in purine nucleotide metabolism in the parasite are being studied.

New Chemistry Unit (NCU)

Several aspects of the chemistry of materials are being pursued by the research team led by *Prof. C.N.R. Rao*. These include transition metal oxides, nanomaterials and carbon materials. In transition metal oxides, multiferroic and magnetoelectric oxides are of interest. Work on inorganic nanomaterials includes synthesis, characterization, study of properties and phenomena. Carbon nanotubes and graphene are important areas being investigated.

Dr. T. Govindaraju's research activities were at the interface of chemistry and biology (*Organic synthesis, molecular probes, peptide chemistry, nucleic acid chemistry and bionanotechnology*). The design and synthesis of small molecules had been actively pursued including peptides, nucleic acids and their conjugates based biomimetic systems and materials possessing well defined nano-, meso- and micro-structures with properties similar to natural materials through Nature-inspired molecular self-assembly approach.

Dr. Jayanta Haldar had focused on infectious diseases in his research which continue to be one of the greatest health challenges worldwide and the threat is compounded by the fact that an increasing percentage of pathogens are developing resistance against the available drugs. The main focus of his research was towards the development of chemical and nanotechnology based innovative strategies to prevent the spread of infections and the development of new antimicrobial agents for the treatment of infectious diseases.

Dr. Kanishka Biswas's research group was focused on the synthesis and thermoelectric properties of cubic I-V-VI_2 (where I = Cu, Ag, or alkali metal; V = As, Sb, Bi; and VI = S, Se, Te) compounds both in bulk and nanocrystalline phases. Thermoelectric figure of merit, *ZT* of ~ 1.2 in lead free I-V-VI_2 compounds containing earth abundant Se in place of traditional rare and costly Te had been achieved, which has remarkable fundamental and technological importance.

The primary focus of research of *Dr. Ranjani Viswanatha's* research group was the synthesis and study of optical and magnetic properties of semiconductor nanocrystals. Towards that goal, her research group have been involved in the synthesis of Cu doped CdSe to use copper as a nanosensor to study the electronic structure and surface properties of CdSe.

Dr. Sebastian C. Peter's research group had focused on research in solid state inorganic materials such as intermetallics, chalcogenides and polyoxometalates from exploratory synthesis. They had discovered several new intermetallics, which are interest in terms of the structural diversity and physical properties.

The interface between synthetic efforts on π-conjugated systems and the organization of these molecules using supramolecular self-assembly principles, with the ultimate aim of developing novel functional materials was the underlying theme of research of *Dr. Subi Jacob George's research group*. In their approach, they targeted the electronic, optical and self-assembling properties of the π-conjugated backbone for the design of materials.

Dr. Ujjal Gautam's research group has investigated the possibility of C-H bond activation using metal peroxides with low decomposition temperatures. They had also investigated the efficient production of hydrogen fuel from

water by using semiconductor nanomaterials as catalysts.

Prof. H Ila's research group had been involved for several years in design and development of new, highly efficient, innovative general methods for synthesis of a large variety of structurally diverse five/six membered heterocycles and their condensed analogs, which are structural components of a large number of pharmaceutical agents as pharmacophores of considerable importance. It was found that these new synthetic protocols are highly effective for heterocycle synthesis and elaboration of diverse substitution pattern for complexity generation on heterocyclic frameworks and are especially suitable in combinatorial chemistry for rapid generation of combinatorial libraries for discovery and optimization of new lead structures in drug discovery research.

Prof. Swapan K. Pati's research group had worked on catalytic activities of a number of systems: Methane formation from hydrogenation of carbon dioxide on Ni (110) surface has already been studied.

Prof. A. Sundaresan's research group had investigated two new families of multiferroic materials, namely RMO_3 (M = Cr and Fe) and $YMM'O_3$ (M and M' are two different transition metals such as Cr, Mn and Fe).

Prof. M. Eswaramoorthy*'s reseach group* had used aminoclay and laponite materials as scaffolds to organize organic chromophores and studied their light harvesting applications. It was discovered that these supramolecularly assembled, soft-hybrids are water-processable, showed high-transmittance and can be used for environmentally friendly, large-area-display fabrication.

Dr. Sridhar Rajaram's reseach group had explored perylene diimides as alternatives to fullerenes in organic solar cells. They showed that disrupting the planarity leads to a tenfold improvement of efficiency.

Dr. Tapas Kumar Maji's research group was actively involved in exploring various functional aspects of metal-organic frameworks (MOFs), covalent-organic frameworks (COFs) and conjugated microporous polymers (CMPs). Recently, They have synthesized a multi-chromophoric hybrid system where exciplex emission sensitized by energy transfer which is unprecedented.

Theoretical Sciences Unit (TSU)

Prof. Umesh V. Waghmare's research group worked in the area of multi-scale simulations of materials; fundamental Physics and Applications of Graphene; Materials with magnetoelectric coupling. Contributions were made to theory of electronic topological transitions, surfaces and interfaces.

Dr. N. S. Vidhyadhiraja's research group had pursued research in two directions: one is the development of a reliable and fast quantum many body technique for integration with band structure methods to be used for predictive modeling of strongly correlated electronic systems (SCES). The second direction is about investigations of heterogeneity in SCES.

Dr. Subir K. Das's research group has been actively involved in studies of equilibrium and nonequilibrium properties of various condensed matter systems.

Dr. Kavita Jain has worked in the area of adaptation dynamics of asexual populations in periodic selection regime; and evolution of mutation rates in adapted populations.

In *Prof. Swapan K. Pati's* group, research interests encompass a broad spectrum of condensed matter phenomena including excitation characteristics, low-temperature thermodynamics and dynamical behavior of a range of quantum systems. Methane formation from hydrogenation of carbon dioxide on Ni (110) surface has been studied.

International Centre for Materials Science (ICMS)

ICMS has expanded its infrastructure by installing sophisticated equipments like Superconducting Quantum Interference Device (SQUID), Inductively Coupled Plasma, Optical Emission Spectrometry (ICP-OES), UV Spectrometer, Photoluminescence Spectrometer (PL), etc. 9 scientists have visited ICMS under its short-term visitors' programme and. 2 have visited under the SSL project. It has also conducted several meeting and conferences during the financial year.

The Centre during the year has appointed Dr. Raju V. Ramanujan of Nanyang Technological University as Adjunct

Professor. RAK-CAM Sheikh Saqr Junior Fellowship has been awarded to Mr. Rana Saha and Ms. Sharvani S was awarded the Post Graduate Diploma in Materials Science.

Prof. C.N. R. Rao's group has initiated two major programmes on energy research: one related to artificial photosynthesis involving photocatalytic oxidation of water by nanoparticles of Mn and Co oxides and the other on photocatalytic H_2 generation by hybrid nanostructures by using the Z-scheme. Synthesis, characterization and properties of anions substituted metal oxides where in oxygen is replaced by nitrogen and fluorine are being investigated.

Significant progress has been made on the formation and properties of nanomanifestations of III-nitride materials at *Prof. Shivaprasad's group*. Observation of magnetism at the apex of the nanowalls, coherent emission at the open screw dislocations and application as a versatile SERS substrate have been the highlights.

Aberration corrected atomic resolution imaging and quantification of oxygen atoms in ZnO has been performed by *Dr. Ranjan Datta's group*. Magnetic information from length scale as small as 5 nm from CrO_2 in a TEM.

Research in the Soft Matter Lab of *Dr. Rajesh Ganapathy* mainly focused on two broad themes. The first was to understand the role of an external driving force on the dynamics of grain boundaries in sheared polycrystals. The second theme was to explore the role of particle shape anisotropy on glass transition dynamics and suspension rheology.

Perylene diimides were explored as alternatives to C70fullerenes in organic solar cells in the group of *Dr. Sreedhar Rajaram*. They showed that disrupting the planarity leads to a tenfold improvement of efficiency.

The primary focus of *Dr. Ranjani Vishwanatha's research group* is the synthesis and study of optical and magnetic properties of semiconductor nanocrystals. Towards that goal, they have been involved in the synthesis of Cu doped CdSe to use copper as a nanosensor to study the electronic structure and surface properties of CdSe.

Thematic Unit of Excellence in Computational Materials Science

The molecular features which govern the mechanism of supramolecular polymerization have been identified and delineated. Density functional theory and empirical potential based MD simulations of liquid dimethyl carbonate, an environmentally benign solvent have shown clustering of conformers with high dipole moment.

It was discovered, through density functional theory calculations, that doping the oxide substrate with an electron donor significantly reduces the barrier for oxygen dissociation on gold nanoparticles.

It has been shown that functionalizing graphene, either with various organic moieties on the edge, or by depositing various metal adatoms, significantly increases the binding of gases such as hydrogen and methane. This has implications for on-board vehicular storage applications.

It has been shown that the finding that magnetism drives surface alloy formation for FeAu/Ru(0001) does not hold for FeAu/Mo(110). This can be attributed primarily to the different nature of magnetic moments on substrate atoms in the two cases.

The electronic structure and energetics of defects in twisted bilayer graphene have been explored.

The effects of lead geometries on spin transport, spin spirals in surface alloy systems, photoswitching van der Waals crystals, and modification of surface work function by mixed SAMs.

A tri-lateral (India-UK-USA) grant was received to support research on solution of graphene and BN.

Academic Activities

During the year, forty two students joined the Centre during August 2012 admissions including seven students who joined during mid-year admission in January 2013. The present student strength is 273. Sixteen students were awarded Ph D degrees, four with M S (Materials Science), seven with M S (Eng.), three with M S in Biological Sciences and one student was awarded M S in Chemical Sciences.

Fellowships & Extension Programmes

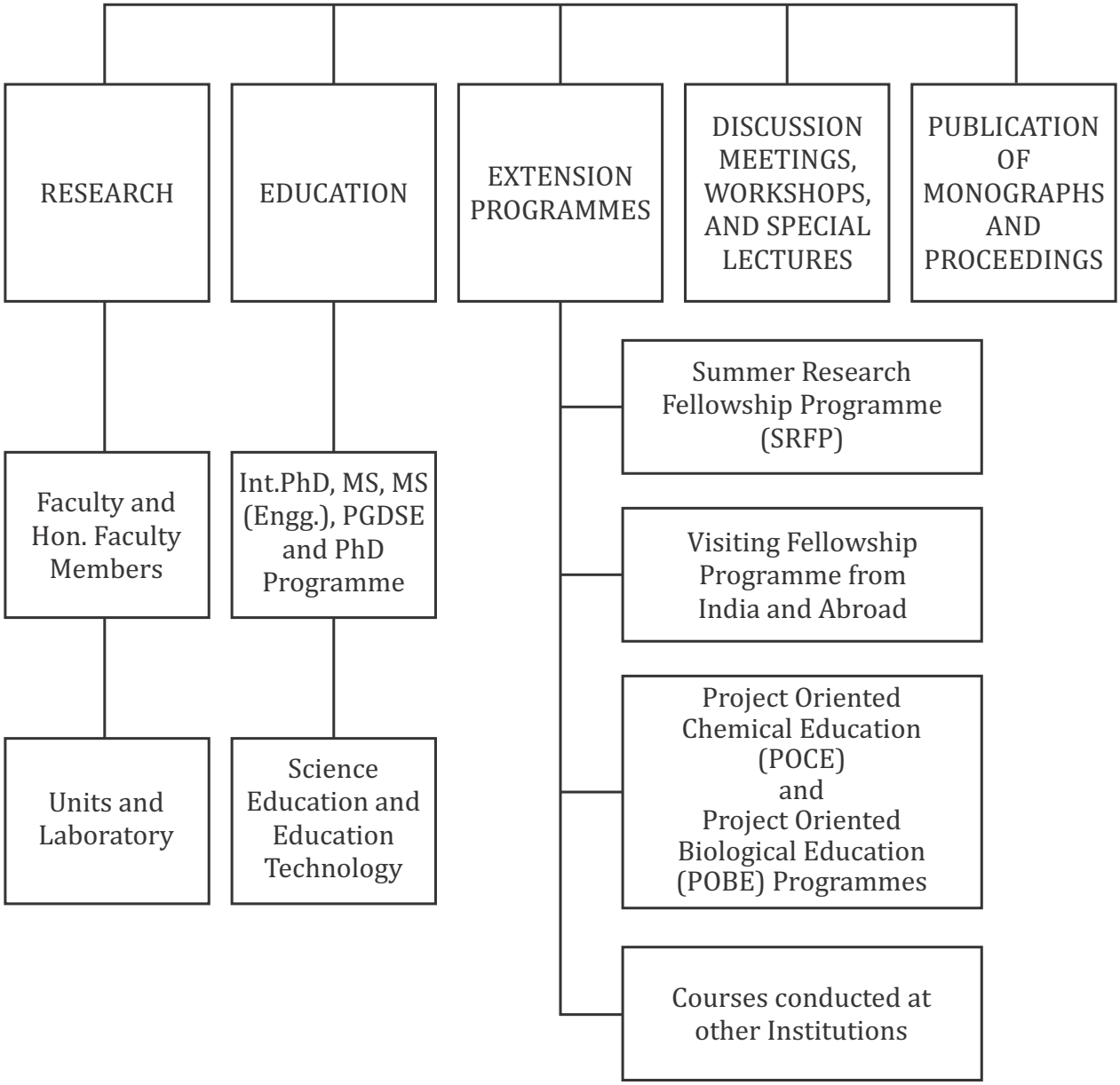
For the Summer Research Fellowships programme, 73 students were selected and offered the fellowships this year. For POCE 2013-15, 10 meritorious students were offered the fellowship. Nine students of POCE-2010-12 were awarded Diploma in Chemistry. Under POBE 2013-15, 10 candidates joined the programme. Eight students of POBE 2010-12 batch received their Diploma in Biology certificates this summer on successful completion of their 3 year project training. Eight candidates have been selected to the Visiting Fellowships Programme 2012-13 under the Physical Sciences category and two under the Biological Sciences category. JNCASR-CICS Fellowship were awarded to 8 candidates from Nigeria, Yemen, Bangladesh and Armenia.

Reservation, Official Language and Implementation of the judgments/orders of the CAT

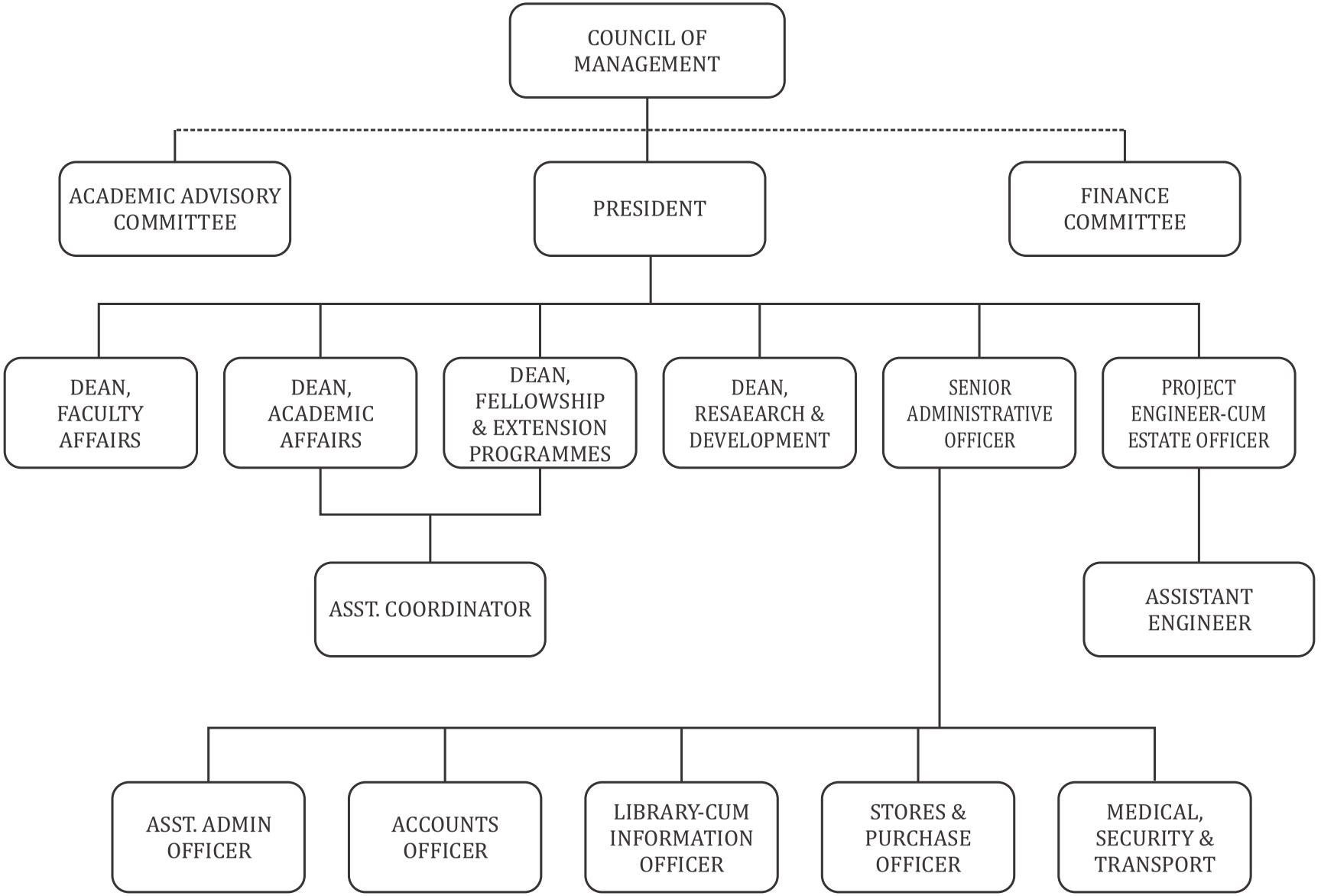
The Centre follows the national policy on reservation and official language as per rules and orders issued by the Government of India with necessary guidelines from the Council of Management from time to time. During the current year there were no cases pertaining to the Centre appeared before the CAT.

ACTIVITIES CHART

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH



ORGANISATION CHART



THE ORGANISATION

Council of Management

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:

Dr. P. Rama Rao Hyderabad	Chairman
Prof. M.R.S. Rao President, JNCASR	Member
Prof. C.N.R. Rao Hon. President, JNCASR (JNC nominee)	Member
Dr. T. Ramasami Secretary, DST	Member
Ms. Anuradha Mitra (2011-14) Joint Secretary & Financial Adviser Department of Science & Technology	Member (Ex-officio)
Dr. Baldev Raj (2011-14) Director, IGCAR (DST nominee)	Member
Prof. Chandan Dasgupta (2011-14) IISc (IISc nominee)	Member
Prof. S.K. Joshi NPL, New Delhi (UGC nominee)	Member
Prof. P. Balaram Director, IISc	Member
Mr. A.N. Jayachandra Sr. Administrative Officer, JNCASR	Secretary

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:

Prof. M.R.S. Rao President, JNCASR	Chairman (Ex-officio)
Prof. C.N.R. Rao National Research Professor, JNCASR	Member
Ms. Anuradha Mitra Joint Secretary & Financial Adviser, DST	Member
Shri. R.S. Gururaj Sr. Accounts Officer, JNCASR	Member (Ex-officio)
Prof. Chandan Dasgupta Dean, Undergraduate Studies, IISc	Member
Shri A.N. Jayachandra Sr. Administrative Officer, JNCASR	Secretary (Ex-officio)

The Academic Advisory Committee

The functions of the AAC include 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 on all academic matters.

The members of the Academic Advisory Committee are:

Prof. M.R.S. Rao President, JNCASR	Chairman (Ex-officio)
Prof. K.B. Sinha Dean, Faculty Affairs, JNCASR	Member (Ex-officio)
Prof. G.U. Kulkarni (2012-14) Dean, Academic Affairs, JNCASR	Member (Ex-officio)
Prof. Namita Surolia (2012-14) Dean, Fellowships and Extension Programmes, JNCASR	Member (Ex-officio)
Prof. Chandrabhas Narayana (2010-12) Dean, Fellowships and Extension Programmes, JNCASR	Member (Ex-officio)
Prof. K.S. Narayan (2012-14) Dean, R&D, JNCASR	Member (Ex-officio)
Prof. Hemalatha Balaram (2010-12) Dean, Academic Affairs, JNCASR	Member (Ex-officio)
Prof. V. Nagaraja (2012-14) Professor, MCB, IISc	Member
Prof. U. Ramamurty(2012-14) Professor, Mat. Engg., IISc	Member
Prof. George K Thomas (2012-14) IISER, Thiruvananthapuram	Member
Prof. D.D. Sarma SSCU, IISc	Member
Prof. Devang V Khakhar Director, IIT, Mumbai	Member (UGC Nominee)
Mr. A N. Jayachandra Sr. Administrative Officer, JNCASR	Secretary (Ex-officio)

Faculties

All the faculty members are involved in various academic activities of the Centre and assist the Academic Advisory Committee in discharging its functions. The last Annual Faculty Meeting was held in November 2012 which included lectures by the faculty on the advances made in various research areas. Local faculty meetings were held in August 2012 and March 2013 to review the progress and provide inputs wherever required.

Administration

President	
M R S Rao	Ph D (IISc), F A Sc, F N A, F N A Sc, FAMS, FTWAS
Dean, Faculty Affairs	
K B Sinha	Ph D (Univ. of Rochester), F A Sc, F N A, FTWAS
Dean, Academic Affairs	
G U Kulkarni	Ph D (IISc)
Dean, Fellowships and Extension Programmes	
Namita Surolia	Ph D
Dean, Research and Development	
K S Narayan	Ph D (Ohio State Univ., USA), F N A Sc, F A Sc
Warden & Student Counsellor	
S.M. Shivaprasad	Ph D
Associate Warden	
Maneesha Inamdar	Ph D
Sr. Administrative Officer	
A N Jayachandra	B Com (Mysore), ICWA (Inter)
Assistant Administrative Officer	
C S Chitra	B Com (Bangalore)
Assistant Coordinator	
Princy Jaison Pereira	Ph D (Gujarat)
Sr. Accounts Officer	
R S Gururaj	B.Sc. (Mysore) M P Ed (Bangalore)
Stores & Purchase Officer	
K Bhaskara Rao	M.Sc. (Hyderbad), M Phil (New Delhi)
Library-cum-Information Officer	
Nabonita Guha	MLIS (Varanasi)
Secretary to President	
A Srinivasan	B A (Hyderabad)
Project Engineer	
S Chikkappa	B E (Mysore)
Junior Engineer (Civil)	
Nadiger Nagaraj	DCE
Junior Engineer (Elec.)	
Sujeeth Kumar S	DEE

Consulting Medical Officer

B S Subba Rao	MBBS (Mysore)

Consulting Lady Medical Officers

Kavitha Sridhar	MBBS (Bangalore)
Archana, M L V	MBBS (Bangalore)
HV Chandralekha	MBBS

Physiotherapist

Y Yogesh	BPT – Mangalore

Honorary Medical Officers

G R Naghabhushan	MBBS (Mysore), FCCP, FCGP, P G Dip in M&CH
L Sharada	MBBS (DGO - Madras)
C Satish Rao	MBBS (Mysore)
P K Raghupathy	MBBS (RGU)
R Nirmala	MBBS (Madras)

Honorary Security Officer

M R Chandrasekhar	B Sc, LLB (Bangalore)

UNITS, CENTRES, COMPUTER LABORATORY, LIBRARY AND ENDOWED RESEARCH PROFESSORS

Chemistry and Physics of Materials Unit

Clay-RGO hybrids have been prepared and their application in simultaneous adsorption of protein and DNA has been investigated. The water dispersible aminoclay is very efficient in dispersing the reduced grapheme oxide(RGO) in water at higher concentration. The as-prepared clay-RGO hybrids show amphiphilic behavior and show good adsorption for DNA and proteins.

Hierarchical metal structures have been synthesized by a modified approach to nanoimprint lithography. A multi-state memory device has been realized based on electrically activated Pd oxide.

Work has been undertaken towards understanding the formation of a) low carrier concentration InN thin films and its dependence on the kinetics of growth and surface modifications, and b) atomistic details of the wurtzite GaN nanorod and nanotubes formation on Al_2O_3 substrates.

The molecular features which govern the mechanism of supramolecular polymerization have been identified and delineated. Density functional theory and empirical potential based MD simulations of liquid dimethyl carbonate, an environmentally benign solvent have shown clustering of conformers with high dipole moment.

Two new families of multiferroic materials were investigated, namely RMO_3 (M = Cr and Fe) and $YMM'O_3$ (M and M' are two different transition metals such as Cr, Mn and Fe). Although these materials have centrosymmetric structures they exhibit ferroelectricity at the magnetic ordering temperatures. The origin of ferroelectricity in RMO_3 has been attributed to a combined effect of electric poling field and 3d-4f interactions. In the latter case, it is due to disorder at the B-site of the perovskite structure. Several other oxides were investigated for multiferroic properties.

The Molecular Electronics lab carried out studies of photo-physical properties of semiconducting polymers. Organic Photovoltaic and Field Effect Transistor devices had been fabricated and studied. The utility of conducting polymer interfaces for studying biophysical problems had been explored.

Raman studies of RMO_3 (M = Cr, Fe, Mn) were carried out to understand the microscopic origin of multiferroicity in these compounds. Microscopic origin of gas adsorption in metal organic frameworks was investigated using Raman spectroscopy. First demonstration of SERS as a tool for determining small molecule binding to therapeutic proteins was demonstrated in the case of Felodipine and Aurora A.

New programme launched

High Pressure Brillouin Spectroscopic studies of topological insulators is being undertaken for the current academic year.

Following are the members of the Unit:

Chair

S Balasubramanian	Ph D, F A Sc

Professors

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
S Balasubramanian	Ph D, F A Sc
K S Narayan	Ph D, F N A Sc, F A Sc.
G U Kulkarni	Ph D
S M Shivaprasad	Ph D
N Chandrabhas	Ph D, F N A Sc

Associate Professors

A Sundaresan	Ph D
M Eswaramoorthy	Ph D

Tapas Kumar Maji Ph D

Technical Officers

V Sreenath (BE), S Srinivas (BE), Usha Govind Tumkurkar (M Phil)

Research Students

Partha Pratim Kundu, Narendra Kurra, Anshuman Jyothi Das, Sandeep Kumar Reddy, Satish Shetty, Venkata Srinu Bhadram, Jaya Ramulu Kolleboyina, Satyaprasad Premswarup Senanayak, Malleswararao Tangi, K.D. Mallikarjuna Rao, R. Bharath, K. Hima Nagamanasa, Ravichandran S, B.V.V.S Pavan Kumar, Gangaiah Mettela, Loukya Chowdary B, Rajdeep Singh Payal, Umesha Mogera, Amritroop Achari, Dhanya R, Gopalakrishnan K, Venkata Suresh M, B. Satyanarayana, Yelipeddy Sreedhar, S. Kiruthika, B. Karteek Kumar, A.Z. Ashar, Tarak Karmakar, Nivedita Sikdar, Devendra Singh Negi, Arpan De, Somnath Ghara, Sunita Dey, Sunil Walia, Sreedhara M.B, Sanjay Kumar Nayak, Amritha Rangarajan, Swathi, Papri Sutar, Dheeraj Kumar Singh, Ritu Gupta, Nitesh Kumar, Urmimala Maitra, Nisha Mariam Mammen, Soumik Siddhanta, Piyush Kumar Chaturbedy, Vini Gautam, Arpan Hazra, S.R.K. Chaitanya Sharma Y, Chidambar Kulkarni, Dileep Krishnan, Gayatri Kumari, M. Pandeeswar, Rana Saha, Sudeshna Sen, Varun Thakur, Dibyajyoti Ghosh, Anindita Chakraborty, Prashant Kumar, Ankush Kumar, Ram Kumar, Sisir Maity, Chandan Kumar, Chandan De, Anirban Mondal, Koushik Pal, Abhijit Sen, Rajib Sahu, Dipanwita Dutta, Sonu K.P., Kandula Neelima, Raaghesh A.V., Suchitra, Uttam Gupta, Sohini Bhattacharyya, Shantanu Aggarwal, Vikas Garg, Shivakumar D.T.

Research Associate

N Padmavathy

Research Associate (Provisional)

B E Prasad

Technical Assistant

N R Selvi

R & D Assistants

Swati Chakraborty, Dhruv Joshi, Syamantak Roy, Sandheep P R

Junior R&D Assistant

Bhavya D R

Staff

Vijay Amirtharaj A, Ananda Raman

Education Technology Unit

Activities and Achievements

The Education Technology Unit has been actively involved in the concept, development and production of multimedia CD-ROM's and books especially for school students and teachers in various disciplines of science since its inception. The Unit has been involved in developing and producing CD-ROMs and books in vernacular Indian languages.

The C.N.R. Rao Hall of Science and Education Technology Unit has continued conducting the highly popular Teachers/students programs/workshops for students and teachers. These workshops/programs are conducted in different subjects like Physics, Chemistry and Biology.

The Book `Rasaayanshaastrada Arivu' authored by Prof. C.N.R. Rao was translated by Mrs. Indumati Rao. It was edited, formatted and a print-ready copy was produced by ETU for Karnataka Rajya Vijnana Parishath (KRVP). The book sponsored by Vision Group on Science & Technology, Dept. of Science & Technology, Govt. of Karnataka to commemorate International Year of Chemistry-2011 was released at a function held at AMRL Conference Hall, JNCASR on March 12, 2012. Prof. P. Balaram, Director, IISc was the Chief Guest.

ETU has collated and produced a document titled `Science Outreach' listing all the Science Popularization Programs organized by ETU under the joint auspices of JNCASR and various institutions across different parts of the country. These programs for students and teachers were conducted by Prof. C.N.R. Rao and Mrs. Indumati Rao.

ETU has brought out a document `Programs of the CNR Rao Hall of Science' on all the Teacher-student programs / workshops organized by the CNR Rao Hall of Science and ETU as part of the Science Outreach Program. The compilation lists the Lecture Programs in different subjects (Physics, Chemistry, Biology etc.) that have been conducted at the Madan Mohan Malaviya Amphitheatre, CNR Rao Hall of Science since its inception in 2009. The report also lists the Science Outreach Programs for students and teachers conducted annually in Uttarakhand. These programs are sponsored by the CNR Rao Hall of Science and they are organized and conducted by CNR Rao Education Foundation and Prof. K.S. Valdiya.

In the POCE program for the year 2012, ETU presented the multimedia CD-ROM `NANOWORLD' and a quiz was conducted from the CD-ROM `Understanding Chemistry' for the students on May 25 & 30. A visit to the `Chemistry of Materials Exposition' and Prof. C.N.R. Rao Archives was conducted by ETU for the POCE students on June11.

A Webpage for the Hall of Science was a project taken up jointly by ETU & Complab. ETU designed the layout and the features of the Webpage. The preparation of the content material (both text and graphics) in the formats as required was completed for the Complab by ETU. The features of the Webpage are designed to be user-friendly and give information about the CNR Rao Hall of Science, people associated with it, its activities, facilities and information about upcoming programs. It has a special feature called `Lecture Videos'. Here the videos of the various lecture programs conducted at the Hall of Science for students and teachers are posted. These lecture videos are available in both High and Low Resolution formats to enable viewers to view these lectures at their convenience. The webpage also provides information about the activities of ETU-SOP-POCE.

ETU created a Logo for the Hall of Science and a special poster for use in the Hall of Science Programs. These were made print-ready for poster printing.

ETU was given the task to format and design a book for the Science Advisory Council to the Prime Minister. The book layout was designed, formatted and the cover was designed by ETU. A print-ready copy of the book titled "Challenges and Opportunities in Science and Technology (Approach to an Action Plan)" was made ready and 10,000 copies were printed.

The CNR Rao Hall of Science Resource Persons meeting was organized on April 26, 2012 to chalk out the Teacher/student Workshops/ Programs to be conducted for the period June2012-December 2012. The meeting was chaired by Prof. C.N.R. Rao. Two Programs each in Physics, Chemistry and Biology were planned along with Special Teacher Training Lecture Programs (in all three subjects) for the benefit of Pre-University Teachers.

Organisation of Programmes

The Summer 2012 Science Outreach Programme sponsored by the CNR Rao Hall of Science, JNCASR was conducted in association with Himalayan Gram Vikas Samiti, Gangolihat by Prof. K.S. Valdiya on May 6-9, 2012. 148 Participants from 24 Govt. intermediate colleges attended the program which had lectures on topics in Science & Engineering from Eminent Scientists.

The CNR Rao Hall of Science and Education Technology Unit conducted 12 lecture programs for students and teachers during 2012. In addition to the planned programs, a program for the CNR Rao Hall of Science and ETU organized the Outstanding Science Teacher Prize function and Lecture Program on June 29, 2012. The awardees for the year 2011 are Shri. S.V. Burli and Smt. M. S. Rekha. In the lecture program that followed the award presentation function Prof. CNR Rao delivered the lecture `Celebration of Science' and Prof. Maneesha Inamdar gave a lecture on `Stem Cells and the Future of Medicine". Around 225 students and teachers attended the program. Prof. C.N.R. Rao unveiled a portrait of Shri. Madan Mohan Malaviya at the CNR Rao Hall of Science Amphitheatre. ETU along with Complab designed and developed a Web Page for the CNR Rao Hall of Science. This was launched at the above function by Prof. M.R.S. Rao, President, JNCASR. In addition the special feature called `Lecture Videos' was also demonstrated. These are videos of the various lecture programs conducted at the Hall of Science. ETU organized and conducted a visit to the Chemistry of Materials Exposition and Prof. C.N.R. Rao Archives for the participants.

CNR Rao Hall of Science and ETU organized a Special Teacher Training Three-day Lecture Program in Physics, Chemistry and Biology for PU teachers. In all the three programs there were three lectures followed by a interactive Q&A Session. The P.U. Board, Govt. of Karnataka deputed teachers from various Pre-University Colleges.

In the Biology program, Prof. M.R.S. Rao, Prof. Jyotsna Dhawan and Prof. V. Nagaraja gave lectures. In the Chemistry Program Prof. S. Balasubramanian, Dr. Govindaraju & Dr. Ranjani Viswanatha gave lectures. Dr. Kavita Jain, Dr. Vidhyadhiraja & Prof. Umesh Waghmare gave lectures in the Physics program. Around 100-120 teachers attended these programs.

The Programs/workshops organised by the CNR Rao Hall of Science and ETU and conducted at the Madan Mohan Malaviya Amphitheatre were as follows:

29 June 2012 – Lecture Program (Science Teacher Award Function)

30 July 2012 – Program in Physics for students

6 August 2012 – Special Teacher Training Lecture Program (Program in Biology)

7 August 2012 – Special Teacher Training Lecture Program (Program in Chemistry)

8 August 2012 – Special Teacher Training Lecture Program (Program in Physics)

27 August 2012 – Program in Biology for students

25 September 2012 – Program in Chemistry for students

12 October 2012 – Program in Physics for students

30 October 2012 – INSPIRE Program

30 November 2012 – Program in Biology for students

4 December 2012 – Special Lecture Program

5 December 2012 – Program in Chemistry for students

In each of the above programs over 200 students and teachers participated. All the above programs consisted of lectures and some demonstrations followed by an interactive Question and Answer session. All the above

programs were organized and conducted by CNR Rao Hall of Science & ETU under the auspices of the Science outreach program.

A special lecture program `INSPIRE program' was organized on October 30, 2012 by CNR Rao Hall of Science and ETU for students and teachers attending the INSPIRE-2012 Science Nurture Camp, Tumkur. The half-day lecture program had one lecture each in Physics, Chemistry and Biology.

The `Program in Biology for students' was conducted on November 30, 2012 by ETU & the CNR Rao Hall of Science. All the speakers were from NIMHANS, Bengaluru. On December 4, 2012 a special lecture program was conducted by ETU and the CNR Rao Hall of Science for the students participating in the Regional Children Science Congress organized by Jawahar Navodaya Vidyalayas. The half-day lecture program had a lecture each in Physics, Chemistry & Biology given by the faculty of the Centre. On December 5, 2012 a `Program in Chemistry for students' was organized in which lectures were delivered by Prof. E.W. (Bert) Meijer, Prof. Michael L.Klein and Prof. C.N.R. Rao. Around 225 students and teachers attended the program.

On-going Projects and Future Plans

The unit is engaged in bringing out a book "Pioneers in Chemistry" describing the achievements of eminent and famous scientists. It is planned to produce a book and CD-ROM in geography.

ETU is engaged in producing a book for the Science Advisory Council to the Prime Minister titled `Science in India (2004-2013)'.

As part of the Science Outreach Programs for students and teachers conducted annually in Uttarakhand, Prof. C.N.R. Rao will give the lecture `Nanoworld' (Nano ki duniya) with subtitles in Hindi. Mrs. Indumati Rao will present a 30-minutes Multimedia presentation of the Hindi version of excerpts from the CD-ROM titled `Nanoworld: An introduction to Nanoscience and Technology.

CNR Rao Hall of Science and Education Technology Unit will be organizing teachers/students workshops/programs in different subjects. The CNR Rao Hall of Science and ETU will conduct jointly with NCU two programs in Chemistry for students. It is planned to have a special lecture program called `Nano Day' with lectures, quiz etc. for students. It is proposed to have lectures and demonstrations with different themes in a particular subject. In the above programs faculty from JNCASR, IISc and other institutions will participate.

Following are the members of this Unit:

Chair	
Prof. 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 Officer	
Jatinder Kaur	M Sc
Multimedia Asst. (Hon.)	
Sanjay Rao	B Sc, Cert. Multimedia

Engineering Mechanics Unit

Prof. Roddam Narasimha's group: in the area of Aerospace and Atmospheric Fluid Mechanics, the concept underlying a novel design of optimal wing planforms for turboprop aircraft, determined through special algorithms developed at JNC, have now been confirmed by wind tunnel tests conducted by NAL at IISc. A study of multiple transitions between laminar and turbulent flow on a swept leading edge has been completed and published.

Comprehensive simulations of a free shear layer in a vortex gas have been completed. It is shown that the vortex gas evolves to a stationary state characterizing a variant of Lundgren-Pointin equilibrium. This evolution may be seen as a long process of relaxation, of which an early stage, lasting only a small fraction (appx. 10^{-4}) of the total relaxation period, corresponds to an explosive growth of the free shear layer. This explosive phase represents the classical turbulent fluid-dynamic regime. A method of desingularzing vortex sheet roll up has also been developed and is currently being analyzed.

In atmospheric fluid dynamics entrainment measurements have been made in a transient diabatic jet for the first time. These measurements exhibit large deviations in the values of the entrainment coefficient from those previously associated with steady jets and plumes: even the sign may differ. The first Navier-Stokes Boussineq solutions for a transient diabatic plume have also been obtained.

In *Prof. K.R. Sreenivas's group*, results from the study of nocturnal atmospheric boundary layer has culminated in the publication of a set of three papers, two in Journal of Atmospheric Sciences and one in Quarterly Journal of Royal Meteorological Society (expected to appear online by the end of February 2013). In this study an error was indentified in the flux-emissivity model for radiation widely used by many researchers in the atmospheric community. The error was responsible for spurious cooling reported in many studies, and its effect extends all the way up to 1 km in the atmospheric boundary layer. It was also showed that the codes based on this erroneous formulation showed unrealistic sensitivity to the ground emissivity. Related experimental work (both in laboratory and field) has helped to solve an eighty years old micro-meteorological mystery, lifted temperature minimum (LTM). It was identified that atmospheric aerosols are primarily responsible for this phenomenon and results have impact on the prediction of radiation-fog, and in prescribing the sensible-heat boundary condition for weather and climatic models.

On research related to the unsteady aero-dynamics of insect flight, preliminary measurements of lift forces during flapping flight were gathered. In a collaborative project with Dr. Santosh Ansumali, flow fields and force measurements were compared in the experimental studies with that predicted by 3-D numerical simulations.

In the coming academic year, apart from extending above research, his group is going to get involve in new research projects related to precision-agriculture, saving water and ways to extend agriculture into arid climates and the study of transport process in atmospheric boundary layers.

Prof. Meheboob Alam's research group was involved in experimental works on vertically vibrated binary granular mixtures which lead to exciting new results. A variety of phase-coexisting patterns was uncovered, characterized by the coexistence of patterns having different spatial and temporal symmetries. For example, a period-2 pattern can coexists with a period-1 pattern in a driven binary mixtures -- this finding is in stark contrast to related pattern formation scenario in mono-disperse granular system. It has been discovered that segregation (de-mixing) of different types of particles appears to be the key driving factor for the onset of phase-coexisting patterns. A simple recipe, based on the idea of non-equipartition of granular energy, has been identified to control these patterns.

In the field of Nonlinear Patterns, the research group has used a Landau-type order-parameter theory to understand patterns in three-dimensional sheared granular fluid. The onset of vorticity banding in sheared granular fluid has been explained as a bifurcation from its uniform shear base state. Interestingly, the nature of bifurcation (stationary or oscillatory) is found to depend on mean density and wave number. At moderate values of wave number, the bifurcation scenario, with increasing density, unfolds as: (i) supercritical pitchfork, (ii) subcritical pitchfork and finally to (iii) subcritical Hopf bifurcation. Our results agree with previously found vorticity-banded states in simulations of sheared granular fluid.

For three-dimensional perturbations, Prof. Alam's research group has found that multiple nonlinear states of both stationary and travelling waves can coexist for a given parameter combination of mean density and Couette gap. The vortical motion on the cross-stream plane has been characterized in terms of the fixed/critical points of the underlying flow-field: saddles, nodes (sources and sinks) and vortices have been identified. While the cross-stream velocity field for supercritical solutions in dilute flows contains nodes and saddles, the subcritical solutions are dominated by large-scale vortices in the background of saddle-node-type motions. The latter type of flow pattern also persists at moderate densities in the form of supercritical nonlinear solutions that originate from the dominant 2D instability modes for which the vortex appears to be driven by two nearby saddles. The location of this vortex is found to be correlated with the local maxima of the stream wise vorticity.

Research group led by *Prof. Ganesh Subramanian* worked on the below areas:

Concentration fluctuations in bacterial suspensions: A fluctuating hydrodynamics approach, together with an adaption of a formalism from classical inviscid hydrodynamic stability, has been used to analyse statistical correlations that develop in a bacterial suspension. In particular, the analysis aimed to understand the origin of the large concentration fluctuations predicted in such systems. (Collaborator: Prof. Donald L. Koch)

Bacterial suspension rheology: A singular perturbation approach, together with numerical solution of the governing advection-tumbling equation, has been used to characterize the rheology of a bacterial suspension, and the results will be compared to experiments (Student: Mr. Sankalp Nambiar).

A particle-level simulation has also been carried in order to verify earlier predictions for the instability of a swimmer suspension (Student: Mr. Deepak Krishnamurthy).

Vortex Rings Oscillations: Using the framework developed by a former student (Dr. Anubhab Roy), the spectrum of singular oscillations of a vortex ring was charaterised (Student: Mr. Shashikiran Reddy).

Sonic transition in viscoelastic flows: The nature of the flow field has been examined, in particular, the vorticity fluctuations induced by a sedimenting particle for finite Mach numbers (defined based on the speed of propagation of infinitesimal shear-stress fluctuations), and the change in the character of such fluctuations across a Mach number of unity (Student: Mr. Navaneeth K.M.).

Role of micro-scale inertia in multiphase heat-transfer: A model problem of a shearing flow around a neutrally buoyant drop was examined and a boundary-layer analysis was used to highlight the role played by closed-streamlines in the heat or mass transfer from the surface of the drop. The analysis aimed to calculate the Nusselt number as a function of the viscosity ratio (drop to ambient) and flow-type. (Student: Mr. Deepak Krishnamurthy).

The following are the members of the Unit:

Chair

Kalyan B. Sinha	Ph D, F N A, F A Sc, FTWAS

Honorary Professor

Roddam Narasimha	Ph D, F A Sc, F N A, F T W A S, F R S

Professors

Kalyan B. Sinha	Ph D, F N A, F A Sc
Rama Govindarajan	PhD, FASc, FNASc
K R Sreenivas	Ph D

Associate Professors

Meheboob Alam	Ph D
Ganesh Subramanian	Ph D

Faculty Fellow

Santosh Ansumali	Ph D

Research Students

Dhiraj Kumar Singh, Ponnulakshmi V.K., Ujjayan Paul, Mohammed Istafaul Haque Ansari, Shiwani Singh,

Saikishan Suryanarayanan, K. Siddharth, Lakshminarayana Reddy M.H., Vybhav G R, Shashank H J, Sunil V Bharadwaj, Manjusha Namburi N L D B, Rajesh Ranjan, Navaneeth K M, Rama krishna Rongali, Saikat Saha, Saunak Sengupta, Prasanth P, Dhake Milind Prakash, Sorathiya Shahajhan Hassanali, Thantanapally Chakradhar, Deepak Krishnamurthy, Kanwar Nain Singh, Rashmi Ramaadugu, Deepthi S, Sankalp Nambiar, Jumpal Shashikiran Reddy, Vicky Kumar Verma

Research Associate
Aarthi Sekaran

NBHM Post Doctoral Fellow
Shailendra Kumar Singh

Research Associates (Provisional)
Sachin Yashavant Shinde, Virendra Kumar

R&D Assistants
Nakul Pande, Rayan Chatterjee

Evolutionary and Organismal Biology Unit

The faculty of EOBU continued their research in the broad areas of animal behaviour /phylogeography, chronobiology, evolutionary genetics, neurogenetics, and population dynamics. Research in this unit had been in the areas of (a) biogeography of large mammals in the Western Ghats, (b) social organization in Asian elephants, (c) behavioural, neurogenetic and molecular bases of *Drosophila* circadian clocks, (d) evolution of adaptations to crowding, especially the interplay of food deprivation and waste buildup, (e) fruitflies as a model system for neurodegenerative disorders, (f) behavioural neurogenetics, (g) circadian entrainment by temperature cycles, (h) fruitfly metapopulation dynamics and stability. The Unit also continued to train personnel in the area of whole-organismal biology through the regular PhD, Integrated PhD and MS programmes, as well as through participation of faculty in POBE and SRFP programmes of the Centre as well as similar outreach programmes run by the three science academies and by DST and KVPY.

A few of the most salient research findings are summarized below.

(a) Work on the social structure of female Asian elephants was continued and it was found that this social organization was more fluid than that of African savannah elephants.

(b) While linear dominance hierarchies based on size or relatedness may be expected in elephants as they continue to grow throughout their lives and live in groups of related individuals, it was found that no linear dominance hierarchy exists between or within female Asian elephant groups, suggesting that resource dispersion was more important in influencing dominance relationships. However, there was also some effect of the age of an individual on the probability of initiating a dominance interaction.

(c) Preliminary examination of Asian elephant male dominance relationships showed no linear dominance hierarchy although there was an effect of age here also. Male-male association networks were found, interestingly, to differ in the presence and absence of females.

(d) Synchrony, precision and accuracy of circadian rhythms evolve in fruit fly populations as a correlated response to selection for emergence in a narrow window of time.

(e) Genetic architecture underlying morning and evening emergence in *early* and *late* fruit fly populations is complex; while the genetic basis of circadian period is primarily autosomal and comprise additive interactions, those regulating phase of entrainment involve higher order dominance and epistatic interactions.

(f) Temperature compensation mechanisms help fruit flies achieve strong (Type-0) phase resetting in their circadian clocks.

(g) Unique patterns of adult emergence and activity/rest behaviours, not seen under laboratory conditions, become apparent when *D. melanogaster* are exposed to semi natural conditions A novel approach of studying rhythmic behaviours by visual observations of behaviours across the day and night revealed that the peaks in activity during dawn is likely to be related to courtship related behaviour, while the peak in the afternoon is a response to the high temperature and high light intensity experienced during that time.

(h) Circadian clocks evolve in *D. melanogaster* populations as a consequence of selection for faster pre-adult development.

(I) Evidence was found for a role for the large ventral neurons of *D. melanogaster* in modulating levels of sleep in a photoperiod-dependent manner.

(j) Evidence was found for the role of dTRPA1 an ion channel expressed by *D. melanogaster* in regulating mid-day inhibition of activity under warm-cold cycles. This was obtained using various genetic manipulations and environmental cycles in the laboratory and

under semi-natural conditions, and also by simulated natural conditions in the laboratory.

(k) A study comparing daily activity/rest rhythms of four Drosophilid species under semi natural conditions across seasons revealed that species-specific preferences in the choice of zeitgebers among these closely related and sympatric species. A similar study which compared another important rhythmic behaviour, emergence of adults from pupal cases, was found to be less variable across species but more susceptible to change due to seasonal conditions.

(l) Constant immigration of even a small number of individuals each generation into fruitfly populations has been shown to significantly reduce the magnitude of population size fluctuations and the likelihood of extinction. This simple, easy-to implement method for population stabilization works for both intrinsically unstable and relatively stable populations, albeit through differing mechanisms based on how migration affects the distribution of population size.

(m) Detailed simulation studies reveal that the nature of migration (asymmetric versus symmetric) and the degree of instability of local subpopulation dynamics in two-patch metapopulations interact in bringing about stabilization of the local and global dynamics. In particular, contrary to earlier belief, asymmetric migration is not necessarily more stabilizing than symmetric migration, with the discordance between the gradients of instability and of net migration playing an important role in determining stability. Also, different zones of chaotic dynamics show differing sensitivity to the stabilizing effects of migration.

(n) Typically, density (number of individuals per unit resource) has been used as a convenient descriptor of levels of crowding and is also used as the state variable in simple models of population growth and of density-dependent selection. It has now been shown experimentally that density is not necessarily a good surrogate for level of crowding, as fruitfly populations with identical larval density, but differing absolute amounts of food, exhibit differences in their pre-adult survivorship, development time and dry weight at eclosion. This work has led to the building up of an explanation of how food amounts and larval densities interact to alter the fitness consequences of inter-individual variation in larval feeding rate, urea tolerance and efficiency of food

conversion to biomass. Thus, the suite of traits that evolve in response to chronic larval crowding is likely to be determined by the ecology of the crowded culture in a complex manner that cannot be predicted simply from a knowledge of the larval density alone.

(o) Populations of fruitflies selected for rapid pre-adult development and early reproduction were shown to have evolved incipient reproductive isolation from their ancestral controlsafter about 400 generations of selection. One component of this isolation was due to the heavy mortality of selected line females after mating with control line males, possible mediated by the body size difference between selected and control lines. Further work has found evidence for body-size mediated male ability to harm their mates upon mating whereas female susceptibility to such harm does not appear to be mediated by body size. There is also evidence for body size independent components of male mating fitness, and some evidence for the correlated evolution of reduced levels of inter-locus sexual conflict in the faster developing lines.

The second batch of Integrated PhD students in the Unit successfully completed their two years coursework and, after one year of research, have submitted their MS theses.

In January 2013, the Unit also organized a two-day Symposium on Organismal Biology in memory of our founding Chair, Prof. M. K. Chandrashekaran. The faculty have also been active in delivering lectures at various meetings and workshops around India.

The following are the members of the Unit:

Chair

Vijay Kumar Sharma	Ph D, F A Sc, F N A Sc

Professors

Amitabh Joshi	Ph D, F A Sc, F N A Sc, F N A
Vijay Kumar Sharma	Ph D, F A Sc, F N A Sc

Honorary Professors

Raghavendra Gadagkar	Ph D, F A Sc, F N A, F T W A S
Mewa Singh	Ph D, F A Sc, F N A, F N A Sc
Vidyanand Nanjundiah	Ph D, F A Sc, F N A

DST Ramanujan Fellows

T N C Vidya	Ph D
Sheeba Vasu	Ph D

Research Students

Pankaj Yadav, Priya M.P., Pavitra Prakash, Nandini R Shetty, Antara Das, Nikhil K.L., Keerthipriya P., Vishwanath Varma, Radhika Dilip Shindey, Hansraj Gautam, Anuj Menon, Manishi Srivastava, Singh Viveka Jagdish, Sheetal Potdar, Payel Ganguly, Joydeep De, Avani Mital, Manaswini Sarangi, Geetanjali Prabhakar Vaidya, Abhilash Lakshman, Manan Gupta

Research Associates

Koustubh M Vaze, Shahnaz Rahaman Lone

R&D Assistants

Subhankar Chakraborty, Sajith V S

Geodynamics Unit

The Science Outreach Programme in Uttarakhand were sponsored and funded by C.N.R.Rao Hall of Science. Prof. Valdiya organised these programmes and had participated as a lecturing resource person. Following were the programmes:

1. In Someshwar, district Almora Science Outreach Programme was organised on November 1, 2012, which was attended by 445 student* and 26 teachers from 7 colleges
2. In Gwaldam, district Chamoli, the programme was organised on November 2, 2012. This was attended by 250 students* and 7 teachers from Central School.
3. In Bageshwar, district Bageshar, 600 students* and 25 teachers had attended the programme from Countrywide Public School on November 3, 2012
4. At Rai Gyarsi, district Pithoragarh, 220 students from Primary School and village folks had participated in the programme on November 4, 2012
5. At Danya, district Almora, 386 students* and 16 teachers had participated.

**Pre-university students of Classes XI and XII*

The themes of Prof. Valdiya's lectures were:

(i) Earthquake and landslide hazards

(ii) Grave water scarcity problem and recharging mountain springs

(iii) Evolution of the Himalaya

Research Paper Published

1. Valdiya, K. S., The Saraswati was a Himalayan-born river. ***Current Science*** **2013 (January 10),** *104* (1), 42-52.

Following is the member of the Unit:

Chair

Prof. K. S. Valdiya Ph D

Molecular Biology and Genetics Unit

MBGU currently has several research and training avenues in broad areas of biological sciences. Research in nine of its laboratories spans diverse areas of modern biology with emphasis on biomedicine. These areas of research are: infectious diseases, cancer genomics, human genetics, mammalian stem cells, cardiovascular development, transcription regulation and mechanism of chromosome segregation. In the last two years there has been an active exchange of scientific ideas among this MBGU faculty and colleagues at the centre who are chemists, physicists and engineers. MBGU continues to attract some of the best students from all over the country. Students for the PhD, Integrated-PhD, MS-PhD, POBE and SRF programmes in MBGU are selected through competitive national-level selection process. Our academic programmes aim to provide training in a broad range of genetic, biochemical, cell and developmental biology approaches for basic and translational research. The essence of these programmes is to provide our students, ample flexibility and opportunity for pursuing a contemporary research theme. MBGU has a vibrant and interactive research atmosphere for its students, who find themselves immersed in multiple academic activities including research work presentations, journal club discussions, training workshops, thematic conferences and lectures by visiting scientists, throughout the year. Students are encouraged and supported to present their results at the scientific meetings. Certain important highlights of our work in this previous year are as follows:

Autophagy Laboratory

The laboratory studies autophagy and autophagy-related pathways. A new live cell assay have been designed to kinetically monitory general and selective autophagy pathways and have miniaturized it to suit the high throughput format. Through a genetic and a biochemical screening procedure, novel genes involved in these process have been identified. Future work will include performing a small molecule screening using the HTS and characterizing the mutants involved the autophagic processes.

Molecular Mycology Laboratory

This laboratory is studying structure-function analysis of centromeres of several pathogenic yeasts: *Candida albicans*, *Candida dubliniensis*, *Candida tropicalis* and *Cryptococcus neoformans*. They observed that centromere DNA sequences are rapidly evolving when *C. albicans* and *C. dubliniensis* orthologous chromosomes were analyzed. Centromeres of C. tropicalis have been recently identified. These centromere properties are different from those of *C. albicans* and *C. dubliniensis*. This laboratory also showed that kinetochore formation in C. albicans is a concerted process. Several members of the laboratory are now working to identify small molecules that can be used as inhibitors for a fungal specific protein complex present at the kinetochore.

Transcription and Disease Laboratory

Focus of this Laboratory was to understand the different aspects of chromatin functional dynamics which are responsible for the gene regulation and its link to cellular physiology and pathobiology. Two different diseases are being investigated in this context, namely cancer (oral cancer and breast cancer) and AIDS. It was found that human chromatin associated protein PC4, gets acetylated *in vivo* and possibly enriched in the transcriptionally active chromatin. PC4 knock down stable cell line was generated and was found that indeed it is involved in genome stability. Monoclonal antibodies have been generated against modified and unmodified NPM1, a chromatin interacting protein and a histone chaperone. It was shown that NPM1 does get overexpressed and hyperacetylated in oral cancer. These antibodies are in the process of commercialization. Also, the first of its kind natural and specific inhibitor of the lysine acetyltransferase- PCAF is discovered, and the role of PCAF mediated acetylation was elucidated in the process of muscle differentiation. It was also found that the anti-hypertensive drug, felodipine is a specific inhibitor of Aurora Kinase A by employing Surface Enhanced Raman Spectroscopy (SERS) and molecular dynamic technique, thus a new method of molecular level Drug-Protein interaction identification method was established.

Vascular Biology Laboratory

Over the last year, significant progress was made in understanding mechanisms that maintain stem cell potency. The endosomal protein Asrij was identified as being essential for maintaining the balance between the pluripotent stem cell state and the differentiated state. Further it was showed that Asrij has a conserved function

in maintaining stemness. In *drosophila hematopoiesis*, too Asrij is essential for maintaining the stem cell population. Asrij functions by actively modulating signalling at the level of endosomes. Thus, a novel mechanism was demonstrated that functions via endosomal regulation to achieve control on stem cell potency. It was an continued efforts to understand mechanism of cardiovascular development, by which the cytoskeletal protein rudhira was found to be essential for cell migration and angiogenic remodelling in vivo during mouse development. Rudhira null mutant embryos as well as conditional endothelial-specific knockouts die at mid-gestation due to vascular patterning defects. A transcriptome analysis of rudhira mutants was performed and several key pathways were identified through which rudhira mediates its function. Further analysis of these is in progress.

Molecular Virology Laboratory

Recent analysis from the laboratory found that in India, over the past decade, the HIV-1 subtype C has acquired a stronger viral promoter and is expanding at a substantial rate, replacing the standard subtypeC strains. This is the first time that anyone identified divergent evolution in a major viral subtype of HIV-1. The newly emerging HIV-1 subtype C viruses containing a stronger viral promoter produce more viral particles and a higher viral load, probably providing an enhanced transmission advantage. This finding is perplexing because a stronger viral gene expression should also elicit enhanced immune activation that may be counterproductive to viral fitness. Some researchers believe that subtype C virus has a relatively higher degree of attenuation as compared to other subtypes and as a result is less pathogenic. Current results of this Laboratory propose that subtype C virus exploits a small window of opportunity to make higher viral load without eliciting a higher magnitude of immune activation. Future studies remain needed to further validate this notion. The laboratory is also credited with the most important finding that subtype-C Tat protein is a defective monocyte chemokine and proposed a hypothesis that the under representation of HIV-1 associated dementia in India is correlated to this important genetic difference. The laboratory undertook the evaluation of a polyherbal formulation of the Indian origin as a potential HIV-AIDS therapeutic strategy. The pilot clinical trial, the first of its kind, showed stabilized clinical profile in the study participants.

Human Molecular Genetics Laboratory

This laboratory had examined molecular genetic basis of human neurological disorders: idiopathic generalized epilepsy (IGE), in particular, juvenile myoclonic epilepsy (JME) and a reflex/sensory form of epilepsy widely known as hot water epilepsy (HWE). In addition to examining the role of the known epilepsy-causing alleles in ion-channel genes, Prof. Anand has been exploring possible new molecular mechanisms in the causation of epilepsies. One of the recent findings from this lab comprises identification of an IGE locus and a gene at 3q13-q21 (*EIG8*, OMIM-601199). A new epilepsy gene encoding *CaSR* (extracellular calcium-sensing receptor) at chromosome 3q13-q21 has been discovered by the nominee's laboratory CASR belongs to a family of G-protein coupled receptors. This is the first demonstration of *CaSR*'s function in the context of an epileptic disorder. The CASR protein is expressed in specific sub-regions of the human brain and that this protein 'measures' changes in extracellular calcium levels in the sub-regions and connects this information to intracellular signal transduction pathways in neurons. This contribution is well recognized in the field. Based on these findings, CaSR's biological role in the epilepsy/human brain and the consequences of its misregulation are being addressed in several laboratories abroad. *CASR* has a crucial role in regulating the growth of neuronal processes in the developing brain. The epilepsy-causing R898Q mutation detected by the laboratory has been investigated by a laboratory elsewhere and shown to be a gain-of-function allele that disrupts a critical arginine-rich retention motif of the CASR. This laboratory has gone on to examine this gene further and has identified several patient-specific *CaSR* mutations. On the basis of his studies of this gene in nearly 500 familial and sporadic cases of epilepsy, it appears that an overlapping genetic predisposition may underlie two seemingly distinct clinical entities, generalized and localized epilepsies. It is amply clear that *CaSR*'s function in the human brain is crucial to maintaining normal neuronal excitability. Further studies on the role of *CASR* in neuronal signal transduction pathway may expand the pharmacological repertoire for seizure phenotypes.

Molecular Parasitology Laboratories

Research in these laboratories is focused on understanding metabolism in the malaria parasite *Plasmodium falciparum*. Towards this end the enzymes involved in purine nucleotide metabolism in the parasite are being studied. Comparative structure-function analysis is also being carried out on the homologues from humans and archaea. Adenylosucinate synthetase from *M. jannaschii* has been characterized biochemically. It is an archaeal enzyme that is 100 amino acids shorter than its counterparts from both eukaryotes and prokaryotes. This thermostable enzyme exhibits a biphasic Arrhenius plot with a switch in the rate-limiting step in catalysis contributing to the bend in the plot. GMP synthetase from *P. falciparum* has been kinetically characterized. Our studies show that the parasite enzyme exhibits different inhibition profile from that of the human counterpart suggesting its suitability as a drug target. Characterization of *P. falciparum* adenylosuccinate lyase indicated that the parasite enzyme has retained its specificity for both the substrates, SAMP and SAICAR. The presence of SAICAR specificity suggests that this is probably the only activity of the de novo purine biosynthetic pathway that is retained in the parasite. Active recombinant *P. falciparum* SIR2 has been successfully expressed and purified. Screening for modulators of Sir2 activity led to the identification of surfactin, a depsipeptide produced by *Bacillus subtilis* as a potent inhibitor of the parasite enzyme competing for the NAD^+ binding site. Another Parasitology lab in the unit is focusing its efforts on the role of *Plasmodium* kinases in host-pathogen interactions. Prof. Surolia`s group has been focusing on understanding the molecular mechanism underlying the pathogenesis of cerebral malaria in Indian patients through a `Systems -Biology " approach. The group is also trying to decipher canonical and non-canonical intracellular trafficking pathways in Plasmodium falciparum, in the process they have found some novel proteins responsible for the development of the parasite.The group is also studying proteins involved in host-pathogen interactions.

Chromatin Biology Laboratory

Work in the chromatin TP2 is acetylated *in vivo* as detected by anti-acetylated lysine antibodies and mass spectrometric analysis. Recombinant TP2 is acetylated *in vitro* by p300 and PCAF. p300 acetylates TP2 in its C-terminal domain which is highly basic in nature possessing chromatin condensing properties. Mass spectrometric analysis showed that p300 acetylated 4 lysine residues in the C-terminal domain of TP2. Acetylation of TP2 leads to significant reduction of its DNA condensing property as studied by the CD and AFM analysis. Colocalization studies using GC-selective DNA binding dyes chromomycin A3 and 7-amino actinomycin D and AT selective dye DAPI indicate that TP2 is preferntially localized to the GC-rich sequences. Interestingly, as spermatids mature, TP2 and GC rich DNA moves towards nuclear periphery and in the later stages of spermatid maturation TP2 is predominantly localized at the nuclear periphery. Another interesting observation is the mutually exclusive localization of GC and AT rich DNA in the elongating and elongated spermatids. A combined immunoflourescence experiment with anti-TP2 and anti-TP1 anbtibodies revealed several foci of overlapping localization indicating that TP1 and TP2 may have concerted function role during chromatin remodeling in mammalian spermiogenesis. Chromatin remodeling factor BRDT has been cloned and expressed in insect cells. The recombinant BRDT shows histone chaperone activity *in vitro.* Gene epxression perturbation following down regulation of *mrhl* RNA has been studied. Pathway construction has indicated that *mrhl* RNA plays an important role in the *wnt* signalling pathway.

Following are the members of the Unit:

Chair

Anuranjan Anand	Ph D, F A Sc

Honorary Professors

Dipankar Chatterji	Ph D, F N A Sc, F A Sc, F N A, FTWAS
H Sharat Chandra	Ph D, F A Sc, F N A, FTWAS

Professors

Anuranjan Anand	Ph D, F A Sc
Hemalatha Balaram	Ph D, F A Sc
M R S Rao	Ph D, F A Sc, F N A, F N A Sc, FAMS, FTWAS
Namita Surolia	Ph D, F A Sc, F N A Sc
Ranga Udaykumar	Ph D

Tapas Kumar Kundu	Ph D, F A Sc, F N A Sc, F N A
Maneesha Inamdar	Ph D

Associate Professor

Kaustuv Sanyal	Ph D

Faculty Fellow

Ravi Manjithaya	Ph D

Technical Officer (Veterinary)

R G Prakash	B V Sc & A.H.

Technical Staff

Anand Kumar K, N Jeelan Basha, Prakash RG, Suma BS, Ushasree Pattamatta, V Mohan

Research Students

Abhishek Sinha, Laxmi Narayan Mishra, D. Karthigeyan, Sreyoshi Mitra, Manpreet Kaur, P.K. Raju Pedabaliyarasimhuni, Sanjeev Kumar, Sourav Roy, Nikhil Gupta, Shetty Ronak Kutty, Laxmi Shanker Rai, Gautam Chatterjee, Anjali Verma, Kalpita Rashmi Karan, Deeti K. Shetty, Kirthana M.V., Akhade Vijay Suresh, Khadilkar Rohan Jayant, Senapati Parijat Ramesh, Vijay J., Garima Verma, Shilpee, Malini Menon, Amrutha Swaminathan, Shukla Arpit Prakashkumar, Shalini Roy Choudhury, Simi Muraleedharan, Prabhu S. A., Amit Kumar Behera, Neha Varshney, Stephanie Kaypee, Piyush Mishra, Santosh S., Sutanuka Das, Sweta Sikder, Divyesh Joshi, Arnab Bose, Debosree Pal, Madhura D Joglekar, Palak Agrawal, Barve Gaurav Ramanand, T. Lakshmi Prasoona, Vikas, Shveta Jaishankar, Lakshmi Sreekumar, Surabhi Sudevan, R. Sunaina Singh, S. N. Suresh, Shreyas Sridhar, S Sundar Ram, Mariyam Abdullah Khorakiwala, Lakshmeesha K N, Pooja Barak, Saloni Sinha, Debanjan Mukherjee, Somya Bats, Meenakshi P., Arpitha A Suryavanshi, Alok Javali

Research Associates

Manjira Ghosh Kumar, Mamata Mishra, Sadhan Chandra Das, Sujata Kumari

Research Associates (Provisional)

Mahesh Bachu, Manoj Kumar

R&D Assistants

Vandhana Devi, Sourav Nayak, Saihitha Veerapaneni, Deepthi Sudarshan, Mahadeva Swamy M M, Asif Ahamad Bakshi, B K Viswanada Reddy, Sriram Kannan, Jasper Chrysolite Paul

Junior R&D Assistant

S Manu

New Chemistry Unit

Several aspects of the chemistry of materials are being pursued by the research team led by Prof. C.N.R. Rao. These include transition metal oxides, nanomaterials and carbon materials. In transition metal oxides, multiferroic and magnetoelectric oxides are of interest. Work on inorganic nanomaterials includes synthesis, characterization, study of properties and phenomena. Carbon nanotubes and graphene are important areas being investigated.

Dr. T. Govindaraju's research activities were at the interface of chemistry and biology (*Organic synthesis, molecular probes, peptide chemistry, nucleic acid chemistry and bionanotechnology*). The design and synthesis of small molecules had been actively pursued including peptides, nucleic acids and their conjugates based biomimetic systems and materials possessing well defined nano-, meso- and micro-structures with properties similar to natural materials through Nature-inspired molecular self-assembly approach. These biomimetic materials find applications as biomaterials, drug delivery systems, composites and in bioelectronics. Dr. Govindaraju had been also involved in developing chiral unnatural amino acids and ligands as optical probes for sensing and bioimaging of variety of cations and anions through supramolecular host-guest interactions. The design and synthesis of new class of smart-building blocks for metal directed assemblies for biosensors and smart materials applications had been undertaken. In his laboratory, protocols had been established to develop biomimetic molecular self-assembly-based systems and materials through chiral transcription, amplication and retentive helical memory (studied by sergeants-and-soldiers method and majority rules) for use in chiral technology and to understand spontaneous deracemization and amplication pathways for biological homochirality. Dr. Govindaraju initiated new projects in the area of neurodegenerative diseases (Alzheimer's, Parkinson's, type 2 diabetes, Huntington and prion diseases) and nucleic acid chemistry).

Dr. Jayanta Haldar had focused on infectious diseases in his research which continue to be one of the greatest health challenges worldwide and the threat is compounded by the fact that an increasing percentage of pathogens are developing resistance against the available drugs. The main focus of his research was towards the development of chemical and nanotechnology based innovative strategies to prevent the spread of infections and the development of new antimicrobial agents for the treatment of infectious diseases. Recently, new generation polymeric biomaterials to make any surface antimicrobial had been engineered, which inactivate various pathogenic bacteria completely on contact. Towards therapeutic applications, novel Antimicrobial Peptides Mimics had been developed and was shown that they inactivate various wild-type and drug resistant pathogenic bacteria and are having no *in-vitro* and *in-vivo* toxicity. Recently, various analogues of vancomycin had also been developed that not only combat drug resistant Gram-positive bacterial (MRSA, VISA, VRSA, VRE) infections but also overcome inherent resistance of vancomycin towards Gram-negative bacteria.

Dr. Kanishka Biswas's research group was focused on the synthesis and thermoelectric properties of cubic I-V-VI_2 (where I = Cu, Ag, or alkali metal; V = As, Sb, Bi; and VI = S, Se, Te) compounds both in bulk and nanocrystalline phases. Thermoelectric figure of merit, ZT of ~ 1.2 in lead free I-V-VI_2 compounds containing earth abundant Se in place of traditional rare and costly Te had been achieved, which has remarkable fundamental and technological importance. His group was also involved in green ionothermal synthesis and thermoelectric property studies of ultrathin (2-4 layer) topological insulators such as Bi_2Se_3, Bi_2Te_3, Sb_2Te_3 and solid solutions.

The primary focus of research of Dr. Ranjani Viswanatha's research group was the synthesis and study of optical and magnetic properties of semiconductor nanocrystals. Towards that goal, her research group have been involved in the synthesis of Cu doped CdSe to use copper as a nanosensor to study the electronic structure and surface properties of CdSe. They are also currently in the process of extending these studies to other II-VI semiconductors. The second area of research interest was to actively pursued the synthesis of particles of CdSe/CdS core shell systems that are defect free and hence obtain a near unity quantum yield. These particles are also cast into exploratory devices of light emitting diodes that were found to have efficiencies comparable to the world standards. They had also actively pursued the synthesis of CdTe and CdTe/CdS core shell systems to dope them with magnetic impurities like Fe, Co.

Dr. Sebastian C. Peter's research group had focused on research in solid state inorganic materials such as intermetallics, chalcogenides and polyoxometalates from exploratory synthesis. They had discovered several new intermetallics, which are interest in terms of the structural diversity and physical properties. The low dimensional intermetallic materials had been successfully used as good catalysts in selected chemical reactions.

Their objective of research on chalcogenide systems was to develop materials for photovoltaic and non-linear optical properties, and rare earth doped chalcogenide glass materials for lasers and phase change memory devices. The aim of their research in polyoxometalates was to look newer synthetic and self-assembly pathways and gaining a better insight in the mechanism of the interactions.

The interface between synthetic efforts on π-conjugated systems and the organization of these molecules using supramolecular self-assembly principles, with the ultimate aim of developing novel functional materials was the underlying theme of research of Dr. Subi Jacob George's research group. In their approach, they targeted the electronic, optical and self-assembling properties of the π-conjugated backbone for the design of materials. During the last year, they have initiated the design of solution processable, luminescent organic-inorganic hybrids by the co-assembly of ionic donor and acceptor dyes and laponite nanoclay particles. In addition, they have started a project on the synthesis of dipolar dyes for the design of self-assembled nanostructures with NLO and optical wave guiding functionalities. They had further extended their activities on supramolecular charge-transfer assemblies to impart them with novel properties like ferro-electricity.

Dr. Ujjal Gautam's research group has investigated the possibility of C-H bond activation using metal peroxides with low decomposition temperatures. They had also investigated the efficient production of hydrogen fuel from water by using semiconductor nanomaterials as catalysts. The self assembly of fullerene cocrystals in various solvents to understand the formation mechanisms of certain solvates had been studied which were promising for energy harvesting and electronics. By using their understanding, the use of solvates for separation of crucial solvents had been tried.

Prof. H. Ila's research group had been involved for several years in design and development of new, highly efficient, innovative general methods for synthesis of a large variety of structurally diverse five/six membered heterocycles and their condensed analogs, which are structural components of a large number of pharmaceutical agents as pharmacophores of considerable importance. Their diversity oriented synthesis of these molecules relies upon development of new class of organosulfur building block precursor pool, which are readily accessible in a one pot reaction from a wide range of cheap active methylene compounds. It was found that these new synthetic protocols are highly effective for heterocycle synthesis and elaboration of diverse substitution pattern for complexity generation on heterocyclic frameworks and are especially suitable in combinatorial chemistry for rapid generation of combinatorial libraries for discovery and optimization of new lead structures in drug discovery research.

Another area of Prof. Ila's research interest revolves around design and development of new efficiency increasing one-pot reactions such as domino reactions, multicomponent reactions for accelerating discovery process. Recently, her research group has also explored transition metal which catalyzed C-C and C-heteroatom bond forming reactions for construction of novel heterocyclic scaffolds.

Prof. Swapan K. Pati's research group had worked on catalytic activities of a number of systems: Methane formation from hydrogenation of carbon dioxide on Ni (110) surface has already been studied. Propene to propene oxide on WO_3 surface and doping of Ni(110) surface with Pd and Pt for the Methane formation had also been carried out. His research group has also studied electrochemical cells, with proper choice of Anode, Cathode and electrolyte solutions. Many biological systems, including DNA, G-qudruplexes and their metal-mediated properties had also been explored.

Prof. A. Sundaresan's research group had investigated two new families of multiferroic materials, namely RMO_3 (M = Cr and Fe) and $YMM'O_3$ (M and M' are two different transition metals such as Cr, Mn and Fe). Although these materials have centrosymmetric structures, they exhibit ferroelectricity at the magnetic ordering temperatures. The origin of ferroelectricity in RMO_3 has been attributed to a combined effect of electric poling field and 3d-4f interactions. In the latter case, it is due to disorder at the B-site of the perovskite structure. Several other oxides were investigated for multiferroic properties.

Prof. M. Eswaramoorthy's reseach group had used aminoclay and laponite materials as scaffolds to organize organic chromophores and studied their light harvesting applications. It was discovered that these supramolecularly assembled, soft-hybrids are water-processable, showed high-transmittance and can be used for environmentally friendly, large-area-display fabrication.

Dr. Sridhar Rajaram's reseach group had explored perylene diimides as alternatives to fullerenes in organic solar

cells. They showed that disrupting the planarity leads to a tenfold improvement of efficiency. In organocatalysis, it was proved that alkali metal ions engenders conformational stability and enhances selectivity. A mild synthesis of non-natural amino acids had been developed that avoids the use of toxic HCN.

Prof. Tapas Kumar Maji's research group was actively involved in exploring various functional aspects of metal-organic frameworks (MOFs), covalent-organic frameworks (COFs) and conjugated microporous polymers (CMPs). Recently, they have synthesized a multi-chromophoric hybrid system where exciplex emission sensitized by energy transfer which is unprecedented. Extensive work had been undertaken on nanoscale MOFs for different application like bioimaging, drug delivery and light harvesting. It was also shown that MOFs can act as precursors for synthesis of nanoporous carbon and borocabonitride materials and these carbon materials exhibit significant hydrogen and carbon dioxide storage capacity.

Departmental Activities

1. Dr. Kanishka Biswas has joined the Unit as DST Ramanujan Fellow.

2. The Second Annual Chemistry Lecture was delivered by Prof. Dongyuan Zhao, Department of Chemistry, Fudan University, Shanghai, China on "Hydrothermal Synthesis of Ordered Mesoporous Materials for Applications".

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

Honorary Professor

H. Ila	Ph D, F N A, F A Sc

Faculty Fellows

T. Govindaraju	Ph D
Subi Jacob George	Ph D
Jayanta Haldar (Ramanujan Fellow)	Ph D

DST Ramanujan Fellows

Sebastian C. Peter	Ph D
Ujjal Gautam	Ph D
Kanishka Biswas	Ph D

Associate Faculty Members

Swapan K. Pati (Professor)
A. Sundaresan (Associate Professor)
M. Eswaramoorthy (Associate Professor)
A. Govindaraj (Honorary Associate Professor)
Tapas Kumar Maji (Associate Professor)
Sridhar Rajaram (Faculty Fellow)

Research Students

Avinash M.B., Debabrata Maity, Venkata Rao Kotagiri, Mohit Kumar, Ritesh Haldar, G. Ramana Reddy, Yarlagadda Venkateswaralu, Divakara SS Murthy Uppu, Bhawani N., S. Vijay Kumar, Nagarjun N., Chandradhish Ghosh, Sumanta Sarkar, Shivaprasad Manchineella, Pallavi Bothra, Arjun Kumar Chittoory, S. Yugandar, Udumula Subba Rao, Pramoda K., Ankit Jain, Moumita Rana, Swastika Banerjee, Lingampalli Srinivasa Rao, G. Krishnamurthy Grandhi, Anand Acharya, Avijit Saha, Jiaul Hoque, Satya Narayan Guin, Manoj Kumar Jana.

Research Associate

Shridhar Ashok Malladi

R&D Assistant

Anand Raj

Theoretical Sciences Unit

Prof. Umesh V Waghmare's research group worked in the following research areas: Multi-scale Simulations of Materials: Using first-principles effective Hamiltonian of $PbTiO_3$ in MD simulations with a combination of constrained polarization and thermodynamic integration, a Ginzburg Landau theory derived[DOI: 10.1103/PhysRevB.87.024107], and a free energy landscape based analysis of ferroelectric transition, domain structure and associated dielectric response of $PbTiO_3$ had been provided. This work has accomplished the following important findings: it (a) has determined the nature of the puzzling orthorhombic phase seen experimentally, (b) highlighted the contrast in the domain structures of $BaTiO_3$ and $PbTiO_3$.

Fundamental Physics and Applications of Graphene: first-principles calculations has been used and a thorough analysis of topological defects in graphene had been carried out, identifying their electronic and vibrational spectroscopic signatures that can be used in experiments to characterize the defects in a non-invasive way. Secondly, a theoretical explanation had been given for the unusual ability of graphene to remove pesticides from water, seen experimentally by Pradeep et al, in terms of the water mediated interactions between graphene and pesticides including endosulfan [DOI: 10.1002/smll.201201125].

Materials with magnetoelectric coupling: A theoretical analysis of the multiferroic behavior in $FeAlO_3$ [DOI: 10.1016/j.ssc.2012.07.018] had been given, in terms of coupled phonons, spin and electronic charge degrees of freedom [DOI: 10.1103/Phys RevB.85. 134449]. It was proved that they specifically obtained first and second order coupling between spin and phonons in this class of materials.

There were other contributions to theory of electronic topological transitions, surfaces and interfaces.

Dr. N. S. Vidhyadhiraja's research group had pursued research in two directions: one is the development of a reliable and fast quantum many body technique for integration with band structure methods to be used for predictive modeling of strongly correlated electronic systems (SCES). Such a multi-orbital perturbation theory based solver is there in hand, that has been benchmarked extensively with continuous time quantum Monte Carlo. The research group is in the process of integrating it with a specific band-structure method, namely WIEN2K.

The second direction is about investigations of heterogeneity in SCES. In this context, programs have been implemented for investigating (a) layered structures, and (b) disordered systems. The latter has been done at three levels of increasing sophistication, namely the coherent potential approximation, the typical medium theory and the statistical dynamical mean field theory.

Dr. Subir K Das's research group has been actively involved in studies of equilibrium and nonequilibrium properties of various condensed matter systems. Significant new understanding has been obtained on the following basic problems:

i. Hydrodynamic effects in kinetics of phase separation in bulk as well as confined systems.

ii. Aging properties in kinetics involving solid-sold, liquid-liquid, vapor-liquid and paramagnetic to ferromagnetic transitions.

iii. Phase behavior of systems containing active particles.

iv. Effects of disorder in chemical reaction diffusion systems.

v. Nucleation and growth of droplets in phase transitions.

During the last academic year, under his guidance, three students submitted theses. The details are given below:

1. Shaista Ahmad (jointly with Sanjay Puri); Ph.D. Thesis title: "Phase Transition Dynamics: From fluids to liquid crystals''; Degree will be awarded by Jawaharlal Nehru University.

2. Suman Majumder; Ph.D.Thesis title: "Nonequilibrium Dynamics in Some Phase Transitions: From finite to infinite length''; Degree will be awarded by JNCASR.

3. Saugata Patra; MS-Eng. Thesis title"Numerical Investigation of Pattern Dynamics in Complex Ginzburg-Landau Equation''; Degree will be awarded by JNCASR.

Dr. Kavita Jain has worked in the area of adaptation dynamics of asexual populations in periodic selection regime; and evolution of mutation rates in adapted populations.

In *Prof. Swapan K Pati's* group, research interests encompass a broad spectrum of condensed matter phenomena including excitation characteristics, low-temperature thermodynamics and dynamical behavior of a range of quantum systems. Methane formation from hydrogenation of carbon dioxide on Ni (110) surface has been studied. A large number of work involving various molecules (including fullerenes) over graphene, its B-N analogues and edge states in quantum dots have been studied. Novel electronic transport properties like negative differential conductance (NDC), spin filter, half-metallic, a number of new phenomena when light is shined on the device region have been studied in details. Kagome antiferromagnetic clusters with Dzyaloshinskii-Moriya interactions have been studied to understand magnetic behavior. Many biological systems, including DNA, G-quadruple and their metal-mediated properties have also been explored.

Prof. Swapan and his group plan to work on the following new topics:

(i) Quantum Dot Electronics using quantum many body methods.

(ii) Low dimensional interacting systems for various exotic phase transitions.

(iii) Electrochemical cells (Anode/Cathode/Electrolytes) optimizations.

Following are the members of the Unit:

Chair

Umesh V Waghmare	Ph D, F A Sc, F N A Sc

Vikram Sarabhai Professor and Hon. Professor

Kalyan B Sinha	Ph D (Univ. of Rochester), F A Sc, F N A, FTWAS

Professors

Shobhana Narasimhan	Ph D, F N A Sc
Srikanth Sastry (*on lien*)	Ph D
Swapan K Pati	Ph D, F A Sc, F N A Sc
Umesh V Waghmare	Ph D, F A Sc, F N A Sc

Associate Professor

N S Vidhyadhiraja	Ph D

Faculty Fellows

Kavita Jain	Ph D
Subir Kumar Das	Ph D

Research Students

Madhura Marathe Pradeep, Arup Chattopadhyay, Suman Majumder, Sutapa Roy, Sananda Biswas, Pramod Kumar, Ulman Kanchan Ajit, Nagamalleswara Rao Dasari, Pralok Kumar Samanta, Shirodkar Sharmila Narendra, Kaushlendra Kumar, Alok Kumar Dixit, Summayya Kouser, Sarada S, Wasim Raja Mondal, Priyanka, Saugata Patra, Rukhsan Ul Haq, Sona John, Vasudevan M V, Ananthu James, Jiarul Midya, Subhajit Paul, Anjali Singh, Saikat Chakraborty, Naushad Ahamad Kamar, Vinay Ishwar Hegde, Meha Bhogra, Bradraj Pandey, Arpita Paul, Sukanya Ghosh, Debdipto Acharya, Rajdeep Banerjee

Research Associate

Himadri Barman

Research Associate (Provisional)

Shuvrajyoti Bhattacharjee

International Centre for Materials Science

ICMS has expanded its infrastructure by installing sophisticated equipments like Superconducting Quantum Interference Device (SQUID), Inductively Coupled Plasma, Optical Emission Spectrometry (ICP-OES), UV Spectrometer, Photoluminescence Spectrometer (PL), etc. 9 scientists have visited ICMS under its short-term visitors' programme and. 2 have visited under the SSL project. It has also conducted several meeting and conferences such as: Winter School on "Chemistry and Physics of Materials" with University of Cambridge, UK, and RAK-CAM, December 3-8, 2012, ICMS-RMIT Conference on Smart functional materials, January 28-29, 2013, Indo-Israel Conference on Materials for Nanoscience, Biosensors and Energy, in collaboration with Weizmann University and Mahatma Gandhi University , February 4-5, 2013, Visit of Royal Society of Chemistry as a part of Road Show on February 6, 2013., IWAM 2013 at RAK-CAM during February 24-26, 2013.

The following lectures from distinguished speakers were organized by ICMS: The second Sheikh Saqr Materials Lecture was delivered by Prof. Claudia Felser, Director, Max Plank Institute Johannes Gutenberg University of Mainz, on December 3, 2012. The third Annual Materials Lecture was delivered by Prof. Prof. Ashutosh Sharma, IIT Kanpur, on April 8, 2013 and a talk was delivered by Prof. Veerabhadran Ramanathan, Distinguished Professor of Climate Sciences, Scripps Institution of Oceanography, University of California at San Diego,

The Centre during the year has appointed Dr. Raju V. Ramanujan of Nanyang Technological University as Adjunct Professor. RAK-CAM Sheikh Saqr Junior Fellowship has been awarded to Mr. Rana Saha and Ms. Sharvani S was awarded the Post Graduate Diploma in Materials Science.

Research Activities

Professor C.N. R. Rao's group has initiated two major programmes on energy research: one related to artificial photosynthesis involving photocatalytic oxidation of water by nanoparticles of Mn and Co oxides and the other on photocatalytic H2 generation by hybrid nanostructures by using the Z-scheme. Synthesis, characterization and properties of anions substituted metal oxides where in oxygen is replaced by nitrogen and fluorine are being investigated. Multiferroics and magnetoelectrics continue to be investigated. A novel experimental set-up is being carried out, which involves examining products of electrical discharge of graphite and other materials in various liquid media including argon, nitrogen, water and organics.

Significant progress has been made on the formation and properties of nanomanifestations of III-nitride materials at Shivaprasad's group. Observation of magnetism at the apex of the nanowalls, coherent emission at the open screw dislocations and application as a versatile SERS substrate have been the highlights. High mobility in nano-GaN due to band tail states is being further probed for these materials. The band bending associated with the In top-layer formation has been observed and further experiments to find kinetic ways to form high quality, high mobility InN films are underway.

Aberration corrected atomic resolution imaging and quantification of oxygen atoms in ZnO has been performed by Dr. Ranjan Datta's group. Magnetic information from length scale as small as 5 nm from CrO_2 in a TEM has been studied. ZnO crystal growth has been studied with Co, Mn, S, Li, N doping by PLD for device application.

Research in the Soft Matter Lab of Dr. Rajesh Ganapathy mainly focused on two broad themes. The first was to understand the role of an external driving force on the dynamics of grain boundaries in sheared polycrystals. Experiments were done using the confocal-rheometer, which allows us to track dynamics with single particle resolution under a well-defined shear. The problem is of relevance in numerous industrial processes that tune material performance by altering the spatio-temporal dynamics of grain boundaries. They found that shear introduces an anisotropy in the grain boundary mobilities and leads to directional grain growth. The second theme was to explore the role of particle shape anisotropy on glass transition dynamics and suspension rheology. The specific research problems which were embarked on were to explore reentrant glass dynamics in suspensions of colloidal ellipsoids and the shear-thickening behavior of suspensions of colloidal rods. A high-speed camera had been acquired that will be integrated with our rheometer for extensional rheology measurements on colloidal suspensions. Plans are there to investigate the role an oscillatory shear on the dynamics of colloidal glasses. Synthesis of novel colloidal particles are there in plan including clusters and flexible strings and to explore their role in colloidal self-assembly.

Perylene diimides were explored as alternatives to C70fullerenes in organic solar cells by Dr. Sreedhar Rajaram's research group. They showed that disrupting the planarity leads to a tenfold improvement of efficiency. Further studies using transient absorption spectroscopy have shown that the charge generation characteristics are similar to that of fullerenes. Mobility measurements also indicate the charge transport is as facile as fullerenes. In organocatalysis, they have shown that conformational rigidity can be enhanced using complexation with alkali metal ions. They have developed a synthesis of non-natural amino acids that avoids the use of toxic HCN.

The primary focus of Dr. Ranjani Vishwanatha's research group is the synthesis and study of optical and magnetic properties of semiconductor nanocrystals. Towards that goal, they have been involved in the synthesis of Cu doped CdSe to use copper as a nanosensor to study the electronic structure and surface properties of CdSe. They are also currently in the process of extending these studies to other II-VI semiconductors. The second area of interest that is actively pursued is to synthesize particles of CdSe/CdS core shell systems that are defect free and hence obtain a near unity quantum yield. These particles are also cast into exploratory devices of light emitting diodes that were found to have efficiencies comparable to the world standards. They have also actively pursued the synthesis of CdTe and CdTe/CdS core shell systems to dope them with magnetic impurities like Fe, Co. Electronic Structure study of nanoparticles using doping and study of magnetic properties of nanocrystals doped with magnetic impurities are underway.

Following are the members of the Unit:

Faculty

C.N.R. Rao, F.R.S. , Hon. F. R. S.C., Hon. F. Inst. P., *Director*
S. M. Shivaprasad, Ph.D. (Karnataka), *Professor*, jointly with CPMU
Ranjan Datta, Ph. D (Cambridge), *Faculty Fellow*

Rajesh Ganapathy, Ph. D (IISc.), *Faculty Fellow*
Sridhar Rajaram, Ph. D (Univ. of Utah), *Faculty Fellow*
Ranjani Viswanatha Ph.D. (IISc.), *Faculty Fellow*

Honorary Faculty

A. K. Sood, F. A. Sc., F. N. A., F. T. W. A. S. of IISc.
A. Govindaraj, Ph.D. (Mysore), of SSCU, IISc
U. Ramamurty, Ph.D. (Brown Univ.), of IISc

Adjunct Professors

Timothy Fisher, Purdue (until Sep 2014)
Vinayak Dravid, Northwestern University (until Sep 2014)
Raju V. Ramanujan (June 2012 - June 2014)

Fellow

Jay Ghatak

ICMS Incharge Co-ordinator

Aruna V. Mahendarkar

Research Associates

Mr. Chithaiah P -- SSL
Mr. Nagaraja K K

Technical Assistants

Shivakumar K M, Prajwal D J, Kishor Upadhayaya

Diploma Students

Renu Tomar, St. Thomas college
Ankit Kumar Sharma, Central University of Rajasthan
Manju Unnikrishnan

R & D Assistants

Srishti Arora, Srikanth Revoju ---SSL,

Arnidom Chatterjee --SSL,
Aloke Kumar Ghosh --- SSL

Graduated Students (Post Graduate Diploma Programme)

Bello Adedeji Abdulhakeem from Nigeria
Dzade Nelson Yaw from Ghana
S. Manjunath from Gulbarga University, Karnataka
Arghya Bhowmik from Pohang University, South Korea
Sharvani Shivaprasad, BVB College of Engineering
Bolla Govinda Rao, Acharya Nagarjuna University

Junior Lab Assistant

Munegowda

Visiting Scientists

Dr. Mohd. Ikram, National Institute of Technology, India
Dr. T. Nishimatsu, Tohoku University, Sendai
Prof. Stefano Baroni, Italy
Dr. Nacir Tit, UAE University, Al-Ain, UAE
Mr. Jos Laurie Campbell, RMIT University, Australia
Dr. Prashant Dubey, University of Allahabad, UP
Mr. Felix Fabich, Univeristy Bergakademie Freiberg, Germany
Dr. K. Sakthipandi, K S Rangasamy College of Technology, Tamilnadu
Mr. Ushie Onumashi Afi, Federal University, Nigeria
Mrs. Shruti Nambiar, University of Waterloo, Canada
Dr. Jagaran Acharya, Tribhuvan University, Nepal
Mr. Manjunath Chatti, ISSER, Kolkata
Dr. Mrinmoy De, Northwestern University, USA

Thematic Unit of Excellence in Computational Materials Science

(Formerly known as Centre for Computational Materials Science (CCMS)

Research Activities

The molecular features which govern the mechanism of supramolecular polymerization have been identified and delineated. Density functional theory and empirical potential based MD simulations of liquid dimethyl carbonate, an environmentally benign solvent have shown clustering of conformers with high dipole moment.

It was discovered, through density functional theory calculations, that doping the oxide substrate with an electron donor significantly reduces the barrier for oxygen dissociation on gold nanoparticles. A new framework to understand these results, involving primarily the s and p bands of the gold nanoparticles, have been developed.

It has been shown that functionalizing graphene, either with various organic moieties on the edge, or by depositing various metal adatoms, significantly increases the binding of gases such as hydrogen and methane. This has implications for on-board vehicular storage applications.

It has been shown that the finding that magnetism drives surface alloy formation for FeAu/Ru(0001) does not hold for FeAu/Mo(110). This can be attributed primarily to the different nature of magnetic moments on substrate atoms in the two cases.

The electronic structure and energetics of defects in twisted bilayer graphene have been explored. It has been shown that these defects show clear signatures that can be picked up in STM images.

The effects of lead geometries on spin transport, spin spirals in surface alloy systems, photoswitching van der Waals crystals, and modification of surface work function by mixed SAMs.

Research interest encompasses a broad spectrum of condensed matter phenomena including excitation characteristics, low-temperature thermodynamics and dynamical behavior of a range of quantum systems. Methane formation from hydrogeneration of carbon dioxide on Ni (110) surface has been studied. A large number of work involving various molecules (including fullerenes) over graphene, its B-N analogues and edge states in quantum dots have been studied. Novel electronic transport properties like negative differential conductance (NDC), spin filter, half-metallicity and a number of new phenomena when light is signed on the device region have been studied in details. Kagome antiferromagnetic clusters with Dzyaloshinskii-Moriya interactions have been studied to understand magnetic behavior. Many biological systems, including DNA, G-quadruple and their metal-mediated properties have also been explored.

Multi-scale Simulations of Materials

Using first-principles effective Hamiltonian of $PbTiO_3$ in MD simulations with a combination of constrained polarization and thermodynamic integration, [http://dx.doi.org/10.1103/PhysRevB.87.024107] a Ginzburg Landau theory has been derived, and provided a free energy landscape based analysis of ferroelectric transition, domain structure and associated dielectric response of $PbTiO_3$. This work has accomplished the following important findings: it (a) has determined the nature of the puzzling orthorhombic phase seen experimentally; (b) highlighted the contrast in the domain structures of $BaTiO_3$ and $PbTiO_3$.

Fundamental Physics and Applications of Graphene

First-principles calculations were used and carried out a thorough analysis of topological defects in graphene, identifying their electronic and vibrational spectroscopic signatures that can be used in experiments to characterize the defects in a non-invasive way. Secondly, a theoretical explanation was given for the unusual ability of graphene to remove pesticides from water seen experimentally by Pradeep et al, in terms of the water mediated interactions between graphene and pesticides including endosulfan [http://dx.doi.org / 10.1002/smll.201201125].

Materials with Magnetoelectric Coupling

A theoretical analysis of the multiferroic behavior in $FeAlO_3$ [http://dx.doi.org/ 10.1016/j.ssc.2012.07.018] has been provided, in terms of coupled phonons, spin and electronic charge degrees of freedom

[http://dx.doi.org/10.1103/PhysRevB.85.134449]. They specifically obtained first and second order coupling between spin and phonons in this class of materials.

Contributions to theory of electronic topological transitions, surfaces and interfaces.

New programmes launched during the year
Homogeneous as well as heterogeneous catalysis. Dynamical electronics processes.
Organization of the India-UK Scientific Seminar at the University College, London.
Received a tri-lateral (India-UK-USA) grant to support research on solution of graphene and BN.

Contribution to organization of Conferences/Schools:

- Cambridge-JNCASR Winter School on "Frontiers of Materials Science", JNCASR, Bangalore, December 3-8, 2012.
- Indo-US Workshop on "Advanced and Nano-Materials", JNCASR, Bangalore, January 21-22, 2012.
- Nano-India 2013, the National Meeting on Nano-Science, NIIST, Trivandrum, February 19-23, 2013.

Following are the members of the Unit:

Coordinator
Prof. Balasubramanian Sundaram

Members
Prof. Shobhana Narasimhan
Prof. Srikanth Sastry
Prof. Swapan Pati
Prof. Umesh Waghmare

Associate Members
Prof. Amalendu Chandra, IIT Kanpur
Prof. Sanjoy Bandyopadhyay, IIT Kharagpur
Prof. Prabal K. Maiti IISc, Bangalore
Prof. S. Yashonath IISc, Bangalore
Prof. Tanusri Saha-Dasgupta, S.N. Bose National Centre for Basic Sciences, Kolkata
Prof. Lavanya M. Ramaniah, Bhabha Atomic Research Centre, Mumbai
Prof. P.B. Sunil Kumar, IIT Madras, Chennai
Prof. K.P.N. Murthy, Indira Gandhi Centre for Atomic Research, Kalpakkam
Prof. Charusita Chakravarty, IIT Delhi
Prof. Surajit Sengupta, S.N. Bose National Centre for Basic Sciences, Kolkata
Prof. Gautam Menon, Institute of Mathematical Sciences, Chennai
Prof. B. Jayaram, IIT Delhi
Prof. Rajendra Prasad, IIT Kanpur
Prof. Dilip G. Kanhere, University of Pune
Prof. G.P. Das, Indian Association for the Cultivation of Science, Kolkata
Prof. Ganapathy Ayappa, IISc, Bangalore
Prof. T.A. Abinandanan, IISc, Bangalore
Prof. Indra Dasgupta, Indian Association for the Cultivation of Science, Kolkata
Prof. Dilip Angom, Physics Research Laboratory, Ahmedabad
Prof. Satyavani Vemparala, Institute of Mathematical Sciences, Chennai
Prof. Indira Ghosh, University of Pune

Programme Assistant
Venkatesh K

Staff
Basavaraj T, Bharati Singh, Vijay Amirtharaj A

DST Unit on Nanoscience

Conversion of inorganic carbonates to methane has been carried out using mixed metal carbonates as an alternative way to capture and convert the carbon dioxide, an important environmental problem. It was observed that presence of cobalt facilitate the complete conversion of carbonate to methane.

There has been significant work in the field of nanocarbons. Important contributions have been made in the area of carbon nanotubes as well as graphene, and some of the contributions in this area have received international attention. More importantly, in addition to the nanotubes and graphene made of carbon, graphene analogues of other inorganic layered materials have been synthesized and characterized.

Aminoclay is a layered magnesium organosilicate with the structure analogous to 2:1 trioctahedral smectites, such as talc but with covalently linked organosilicates in place of inorganic silicates, with an approximate composition $R_8S_{i8}Mg_6O_{16}(OH_)_4$ (R= alkylamine covalently linked to Si)· This clay is easily exfoliable in water into nanosheets due to protonation of amino groups. These functional groups are very efficient in stabilizing metal nanoparticles to form clay-metal nanoparticles· Composite film made with the aminoclay slabs and the polymer, polyvinylalcohol, showed enhanced strength without compromising its ductility, a problem commonly encountered in using inorganic filler with the polymer in macro composites. These composite film incorporated with Ag and Au metal could be used as food packaging materials.

Direct write methods have been developed which make use of a variety of metal-organic complexes as single source precursors to produce micro and nanoscale patterns of metals, oxides, sulfides, nitrides as well as of alloys. A desired interface can be easily obtained by exercising control over the chemical treatment. Based on this principle, a few devices such as strain sensor, have been produced. The direct methods not only cut down the number of process steps but also the cost and importantly, enable design of material interfaces which are beyond the conventional lithography.

Following are the members of the Unit:

Faculty members

Prof. C. N. R. Rao
Prof. G. U. Kulkarni
Prof. K. S. Narayan
Prof. Swapan K. Pati
Prof. A. Sundaresan
Prof. M. Eswaramoorthy
Prof. A. Govindaraj

Technical Assistance

Ms. N. R. Selvi

CSIR Centre of Excellence in Chemistry

In January 1991, the CSIR established this person-based Centre of Excellence in Chemistry. The Centre works on various aspects of solid state and materials chemistry. The main activities of this CSIR-Centre deal with the following aspects.

New strategies have been developed for the synthesis, purification, functionalization and solubilization of novel carbon nanostructures such as, carbon quantum dots, graphene, single-walled nanohorns, carbon nanotubes, Y-junction nanotubes, metallic nanotubes, separation of metallic and semiconducting nanotubes from the mixture in a simple method to study the electrical transport, optical and other confinement properties.

Graphene is one of the main areas of research in this laboratory. Synthesis of two to four layer graphene was carried out by arc-discharge of graphite in a hydrogen atmosphere as well as with other conditions. Besides providing clean graphene surfaces, this method allows for doping with boron and nitrogen. Raman spectroscopy is used to investigate the charge-transfer interactions of graphene with electron-donor and -acceptor molecules, as well as with nanoparticles of noble metals.

It was discovered that incorporation of graphene improved the mechanical properties of polymers, its incorporation with nanodiamond or carbon nanotubes exhibits extraordinary synergy. Hybrid nanocomposites of graphene oxide (GO) with zeolitic imidazolate frameworks (ZIF-8) as well as with porous graphene frameworks (PGFs) pillared by organic linkers exhibits interesting gas adsorption properties.

After the synthesis and characterization of graphene, serious attention is paid to other inorganic analogues of graphene. Various chemical methods have been developed for the synthesis of layered transition metal dichalcogendes which includes MoS_2, WS_2, $MoSe_2$, WSe_2, NbS_2 and $NbSe_2$. Their applications in IR detectors, gas sensors, composites with polymers for mechanical properties and electrical properties, magnetic properties, and hydro-desulphurization (HDS) catalysis have been studied. Micromechanical cleavage method has been used for obtaining the single-layers of MoS_2, GaS and GaSe and studied their applications in transistors, detectors and sensors.

The interaction of electron-donor and –acceptor organic molecules have been studied such as tetrathiafulvalene and tetracyanoethylene with different materials such as layered chalcogenides, as well as nanocrystals of ZnO and CdSe. The charge transfer from tetratiafulvalene to few layer MoS_2 can be evidenced from optical measurements.

It was also discovered that nanosheets of transition metal oxides, such as MoO_3 consisting of only a few-layers prepared by different methods exhibits enhanced photocatalytic activity. Also, it was established that in combination with a borocarbonitride, few-layer MoO_3 composite shows good performance characteristics as a supercapacitor electrode.

High surface area borocarbonitrides were synthesized from low cost starting materials like urea, boric acid and activated charcoal. Graphene-like $B_xC_yN_z$ samples exhibit surface areas in the range 1500-1990 m^2/g, with the large uptake values of CO_2 and shows good performance characteristics as supercapacitor electrode.

Photocatalytic water splitting using powder catalyst dispersed in water by simply shining light is one of the most energy effective and easiest ways to obtain H_2 and O_2. Spinel based photocatalysts have been used which contained "Mn_4O_4 cubane" like structure similar to that found in chlorophyll for oxidation water. It was found that nanoparticles of Co, oxides like the spinel $Li_2Co_2O_4$ and the perovskite $LaCoO_3$ shows oxygen evolution in solution containing $Ru(bpy)_3^{2+}$. Amongst the manganese oxides studies, Mn_2O_3 with the bixbyite structure and $LaMnO_3$ with the perovskite structure containing $Mn^{3+}(t_{2g}^3 e_g^1)$ ions show high catalytic activity. N, F co-doped TiO_2 showed maximum hydrogen evolution of 400 moles/g of the catalyst with a rate of ~ 60 moles/g/h without the loading of any noble metal or other co-catalyst.

Multiferroic and magnetoelectric nature of $Al_{1-x}Ga_xFeO_3$ (x=0, 0.5, 1) family of oxides all crystallizing in the orthorhombic structure, with a non-centrosymmetric space group ($Pna2_1$), exhibits both multiferroic and magnetodielectric properties at low temperatures. Similarly $GaFe_{1-x}Cr_x(Mn_x)O_3$ and $Ga_{1-x}Cr_x(Mn_x)FeO_3$ are magnetoelectric as well as multiferroic. $LnCr_{1-x}M_xO_3$ (Ln= Y, Lu; M = Fe, Cr, Mn) family of oxides showed spin-disorder induced ferroelectricity.

Following are the members of this Centre:

Chair

Prof. C.N.R. Rao	FRS, FASc, FNA, FTWAS, Hon FRSC, Hon F Inst P

Hon. Associate Professor

Prof. A. Govindaraj	Ph D

Computer Laboratory (CompLab)

Computer Laboratory (CompLab) is responsible for establishment and maintenance of computer and network facilities at JNCASR, and its connectivity with the rest of the world through internet. Its goal is to continuously evolve the information technology (IT) resources at the Centre that meet the IT requirements of the highly heterogeneous community ranging from Administration, Scientists and Engineers, facilitating cooperation and collaborative interactions amongst them. It interfaces with every Unit and section at JNCASR, seeks inputs from a broad set of users in planning the IT infrastructure. This includes various servers, softwares, local area network (LAN), internet links, multi-media communication over internet and high performance computing (HPC) housed in the Central Facility. In addition, CompLab provides support and services to maintain computing resources in different groups at JNCASR, efficiently through an online ticketing system (http://www.jncasr.ac.in/complab).

CompLab hosts email, web, proxy and gateway servers of the Centre, Link-load-balancer, IronPortC150 (a spam-controller), a Firewall and maintains many other servers that cater to Purchase, Canteen and Labrary. An uninterrupted LAN connectivity within the Centre is achieved at 1 Gbps with Optical Fiber Cable (OFC) backbone, CAT-6 network cables and a manageable chasis switch. The centre is connected to internet via 10 Mbps + 25Mbps leased lines from BSNL & HCL Infotech, respectively. As a member of the National Knowledge Network, Complab is expected to host a link at the band-width of 1 Gbps. Complab maintains HPC resources at a moderate level, and has plans to expand them further. A centralized back-up facility via NAS/SAN helps store critical data from various servers as well as those from the Purchase and Accounts sections. Infrastructural support is given for Windows, Mac and Linux based machines across the Centre.

In addition to the Server and Cluster laboratories, CompLab maintains a 24-hour central computing facility of two terminal rooms with printers and several desktop Linux and Windows PCs running equipped with a wide range of the scientific softwares and databses. Each member of JNCASR has a quota and access to free print-outs from CompLab's high-quality colour and monochrome printers.

In this financial year, CompLab has taken a number of steps to enhance the computing and other IT infrastructure of the Centre. Some of the important activities undertaken are:

- JNCASR users were facing bandwidth issues with the existing deep-root mail solution. This mail client was replaced with a Zimbra email solution, which is able to cope up with increased bandwidth in the campus.
- A new mail server '*Saturn*' has been installed to provide email services to alumni and temporary users of the Centre. This segregation of users into groups has allowed a better utilization of network resources.
- National Knowledge Network connectivity was enhanced to 200 MBPS from existing 100 MBPS line.
- An online system of printing has been installed in the campus. This has lead to better user experience as well as saving of space in the campus.
- A new colour printer and one poster printer have been installed for on-campus users. In-house poster printing facility has lead to substantial saving of time for JNCASR students.

Following are the members of CompLab:

Head

Dr. Santosh Ansumali Ph D

Consultant

Vikas Mohan Bajpai

R&D Assistants

Vishnu Pradeep P V, Kiran Kumar, Divya Shivanna

Library

The Library has a collection of over 8400 books and access to over 5000 scientific journals. Book exhibitions were also arranged. Several new journal titles subscribed. Journal articles were procured on request from faculty members and students from CSIR, DST and other neighboring libraries under document delivery service.

Overview of Collection

Books	
Books procured during 2012-13	364
Total books in collection	8408
Journals	
Online journals subscribed	159
Print journals subscribed	6
Approx. price for newly subscribed journals	₹ 23,69,136.00
Patent database (Derwent Patent Index) – from National Knowledge Resource Consortium	1
Abstracting and Indexing database (Web of Science) – from National Knowledge Resource Consortium	Web of Science, SciFinder
Online journals in collection (Subscription + consortium resources)	Over 5000

Books Acquisition

In the financial year 2012-13, 364 books worth ₹11,21,416/- (Rupees Eleven lakhs twenty one thousand four hundred and sixteen only) were procured in the library based on the recommendations of JNCASR Faculty members.

Journal Subscription and Consortium Resources

The total amount spent for the subscription of both print and online journals for the year 2012-13 is ₹ 90,71,482.00 (Rupees Ninety lakhs seventy one thousand four hundred and eighty two only). Thirty four new journals have been subscribed worth ₹23,69,196.00 (approx.).

Due to financial constraints, some key resources supported by National Knowledge Resource Consortium have been discontinued for 2013 such as journals from American Chemical Society, Springer, Springer Materials.

Document Delivery Service (DDS)

Journal articles on requests from faculty and students were procured from libraries across the country and abroad under Document Delivery Service. Total 362 article requests have been fulfilled through inter-library cooperation. Twenty five articles were purchased online.

Following are the library staff members:

Library-Cum-Information Officer
Nabonita Guha

Senior Library cum Information Assistant Gr. I
Nandakumari, E.

Senior Library cum Information Assistant Gr. II
Nagesh Hadimani

Library cum Information Assistant Gr. II
Senthil Kumar, N.

Library Trainee
Kalpana S. (term ended on September 2012)
Poornima Hosamani

R & D Assistant
N. M. Tara

Helper
Rajeeva, J.

ENDOWED RESEARCH PROFESSORS

Linus Pauling Research Professor

C N R Rao — F R S, D Sc, F A Sc, F N A, F R S, F T W A S, Hon F R S C
Jawaharlal Nehru Centre for Adanced Scientific Research, Bangalore
(Term: Life time)

D S Kothari Chair

M M Sharma — F R S, F A Sc, F N A
Emeritus Professor of Eminence, Mumbai University, Mumbai
(Term: 01/01/1999 to 31/10/2013)

Hindustan Lever Chair

S Chandrasekaran — F A Sc, F T W A S, F N A
Indian Institute of Technology, Madras
(Term: 01/11/2011 to 31/10/2013)

Dr Vikram Sarabhai Research Professor

Kalyan B Sinha — F N A, F A Sc, F T W A S
Jawaharlal Nehru Centre for Adanced Scientific Research, Bangalore
(Term: 01/12/2011 to 02/06/2014)

ACADEMIC PROGRAMMES

Academic Activities

At JNCASR, research is carried out in six Units: Chemistry and Physics of Materials Unit (CPMU), Evolutionary and Organismal Biology Unit (EOBU), Engineering and Mechanics Unit (EMU), International Centre for Materials Science, Molecular Biology and Genetics Unit (MBGU), New Chemistry Unit (NCU) and Theoretical Sciences Unit (TSU). The research undertaken is inter-disciplinary in nature.

The Centre offers Ph. D, Integrated Ph. D, M.S (Research) and M.S Engg . degree programmes in Science and Engineering. Students are admitted to the Units mentioned above. The minimum academic qualification required to apply for the MS/Ph.D programmes of the Centre is M.Sc./B.E./B.Tech./M.E./M.Tech./MBBS degree/s. Candidates applying for M.S./Ph.D. programmes should have at least 50% in their highest University examination, and should also have qualified in GATE/UGC-CSIR-JRF/ICMR-JRF/DBT-JRF/JEST/equivalent examinations. Candidates applying for Integrated Ph.D. Programme of the Centre should have at least 55% marks in their Bachelor's degree in any area of Science or Statistics.

The Centre selects candidates on the basis of their academic record, performance in GATE /UGC-CSIR-JRF/ ICMR-JRF/ DBT-JRF/ JEST/ equivalent examination(s), recommendation from referees and performance in the interview. The selected candidates are offered course work, provided with research facilities for research and on successful completion offered with the degree.

Research Admissions

The present student strength is 273. Forty two students had joined the Centre during the August 2012 admissions. Seven students joined the Centre during January 2013 for the session of 2012-13. The advertisement for the regular admission to the Integrated Ph.D., Ph.D. and M.S. programmes 2013-14 session was released in all the prominent national and regional newspapers and announced on our web site.

Degrees Awarded

The Centre is a Deemed University, and awards Ph.D. and M.S. degrees. Following are the students who have been awarded degrees under the various degree programmes during April 2012- March 2013:

Ph.D.		**M.S. (Engineering)**
Mangaiarkarasi A. K.S. Subrahmanyam Bharath S. Prakash Kanoo Himadri Barman Snigdhadip Dey Moumita Maiti Manoj Kesaria	Jitendra Thakur Surbhi Dhar Jithesh K Pranab Mandal Shipra Mighfar Imam Sumesh P T B Radha	Gangaiah Mettela Sarada S Kaushlendra Kumar Md Istafaul Haque Ansari Gopalakrishnan K Nishit Srivastava Wasim Raja Mondal

Master of Science (M S) in Materials Science	**Master of Science (M S) in Biological Science**	**Master of Science (M S) in Chemical Science**
Anindita Chakraborty Darshana Joshi Dibyajyoti Ghosh Prashant Kumar	V. Sivani Sheetal Potdar T. Lakshmi Prasoona	Ajmala Shireen P

Medal for the best thesis of the year 2011 – 12 in Physical and Biological Sciences categories each: Donated by Prof. CNR Rao

Physical Sciences Category

Name	Research Supervisor	Thesis Title
B Radha	G.U. Kulkarni	Synthesis and Direct Patterning of Functional Nanostructures on Flat and Flexible Substrates towards Device Fabrication

Biological Sciences Category

Name	Research Supervisor	Thesis Title
Jitendra Thakur	Kaustuv Sanyal	Genetic and Epigenetic Factors Determining Centromere Structure and Function in *Candida* Species

Roddam Family Award for the Best Ph.D. Thesis in Engineering Mechanics :

Scroll and cash prize

Ph.D. degree

Name	Research Supervisor	Thesis title
P.T. Sumesh	Rama Govindarajan	Statics and Dynamics of Drops on Solid Surfaces: Theory and Simulations

DISCUSSION MEETINGS

The following discussion meetings were supported by the Centre. The meetings were organized by its faculty in association with faculty of other reputed research institutions in various areas of current interest.

1. Indian Society of Neuro-Oncology (ISNOCON 2012), Dr Vani Santhosh, April 6 - 8, 2012.
2. ACCMS - Theme Meeting on 2D Nanostructures: Graphene and Beyond, Prof. Umesh V. Waghmare, JNCASR, July 29 - 30, 2012.
3. CFM 2012 - Chemical Frontiers, Prof. R. Murugavel, IIT Bombay, August 14 - 16, 2012.
4. Discussion Meeting on Electronic, Optical and Magnetic Materials: experiment and Modeling, Prof. S. Ramasesha, IISc, November 25 - 28, 2012.
5. Meeting of Young Affiliates and Fellows of TWAS in Central & South Asia Region, November 15 - 17, 2012.
6. Fourth International Advisory Board meeting, ICMS, December 3, 2012.
7. EOBU Symposium, January 9-10, 2013.
8. Indo-Israel Meeting, February 4-5, 2013.
9. Visit of Royal Society of Chemistry to ICMS as a part of Road Show on February 6, 2013.
10. Funding and Related Opportunities from ERC, Prof. Donald Dingwell, Secretary General, European Research Council Meeting, March 12, 2013.

ENDOWMENT LECTURES

A.V. Rama Rao Foundation Lectures in Chemistry: *Fluorescent Molecular Architectures with Exceptional Properties*, Dr A Ajay Ghosh, CSIR-Outstanding Scientist, Chemical Sciences & Technology Division, NIIST, Trivandrum and **Prize Lecture**: *Luminescent Nano Materials for Photonic Applications*, Dr Amitava Patra, Department of Materials Science, Indian Association for the Cultivation of Science, Kolkata, May 16, 2012.

Prof. V. Ramalingaswami Memorial Lecture: *Act of Observation and Cancer Biology*, Dr. R A Badwe, Director, Tata Memorial Centre & Hospital, Mumbai, July 9, 2012.

Prof. C. N. R. Rao Oration Award Lecture: *HIV says again - "In failure, I see my success"*, Prof. Ranga Udaykumar, JNCASR, August 6, 2012.

DAE - Raja Ramanna Lecture in Physics: *Novel Electronic Phenomena at Oxide Interfaces*, Dr. Ramesh Chandra Budhani, NPL; Prize Lecture - *Tweaking the magnetic domains and domain-walls in nanostructures: A prospective magnetic memory concept*, Prof. Anil Kumar, IISc, September 28, 2012.

Linus Pauling Lecture: *The Antimicrobial Defense of Drosophila: a Paradigm for Innate Immunity from Flies to Humans,* Prof. Jules Hoffmann, Nobel Laureate, Institute of Molecular and Cellular Biology, University of Strasbourg, France, October 12, 2012.

ISRO Satish Dhawan Lecture: *Science for Musical Excellence of the Mridangam*, Dr. T. Ramasami, Secretary, Department of Science and Technology and Dr. Umayalpuram S. Sivaraman, October 16, 2012.

Sheikh Saqr Materials Lecture: *Heusler compounds: From semiconductors to spintronics*, Prof. Claudia Felser, Director, Max Plank Institute Johannes Gutenberg University of Mainz, Mainz, December 3, 2012.

M.K. Chandrasekaran Memorial Lecture: *Rhythms in time and space*, Prof. Anders Johnsson, Department of Physics, Faculty of Natural Science and Technology, Norwegian University of Science and Technology, Trondheim, Norway, January 9, 2013.

IPR Lecture: *Patent Laws and Its Importance to Scientific Research*, Prof. Srividhya Ragavan, Professor of Law, University of Oklahoma College of Law Norman, OU, USA, March 26, 2013.

GENERAL LECTURE

1. *Staff Orientation Lecture*, Dr. Anand Kumar, JNCASR, July 11, 2012.
2. *Handling Injuries - An Interactive Session*, Dr. V. Yogesh, JNCASR, August 17, 2012.
3. *Paperless Office - An experiment and experience*, Mr. M. N. Vidyashankar, Principal Secretary, Commerce & Industries Dept., Govt. of Karnataka on Monday, October 01, 2012

Lectures delivered at the Annual Faculty Meeting (November 2012)

1. *Design of Molecules for Telomerase Inhibition*, Prof. Santanu Bhattacharya
2. *Organic Photovoltaics: Every Photon Count*s, Prof. K. S. Narayan
3. *Warm cues for the fruitfly clock – the role of a temperature sensitive ion channel in diurnal activity patterns*, Dr. Sheeba Vasu
4. *Possible onset of Transient Universality in Fluid Turbulence*, Dr. Santosh Ansumali
5. *"The richest don't take it all", Directional Grain Growth in Sheared Polycrystals: Evidence for a strain-temperature equivalence,* Dr. Rajesh Ganapathy

CONFERENCES/WORKSHOPS/SYMPOSIA

1. International Conference on Networks in Biology, Social Science and Engineering, Prof. G. Rangarajan, IISc, July 12 - 14, 2012.
2. *Recent Advances in Electrochemical Energy Materials and Devices*, Prof. A. J. Bhattacharyya, July 24 - 27, 2012.
3. TSU In-House Symposium, August 4, 2012.
4. International Conference on Raman Spectroscopy (ICORS 2012), Prof. Chandrabhas Narayana, JNCASR and Prof. Umapati, IISc, August 12-17, 2012.
5. Indo-US workshop on Next Generation of Materials Using Neutrons, September 6-7, 2012, Convenor: Prof. G. U. Kulkarni
6. 9th Kannada Vignana Sammelana, Prof. K.I. Vasu, September 15 - 17, 2013.
7. Publishing Workshop, Institute of Physics, September 18, 2012
8. 8th JNC Research Conference on Chemistry of Materials, Dr. Subi Jacob George, JNCASR, September 30 - October 2, 2012.
9. Indo-Japan Conference on New Functionalities in Electronic and Magnetic Materials, Prof. D. D. Sarma, October 18 - 20, 2012.
10. Two days Symposium on "National Mathematical Year NYM 2012", Shri Sasti Brata, Kabiraj, October 20 - 21, 2012.
11. Thematic Meeting on Lipid Protein Interactions in Membranes: Implications for Health and Diseases, Prof. Amitabha Chattopadhyay, November 1 - 5, 2012.
12. FCBS Workshop for Postgraduate Students and Lectures in Chemistry, Prof. M. V. George, NIIST, Trivandrum, November 8 - 10, 2012.
13. Indo-Taiwan Workshop on Nanodevices, November 26 - 27, 2012.

14. Winter School on "Chemistry and Physics of Materials" with University of Cambridge, UK, and RAK-CAM; Convenors: Prof. S. M. Shivaprasad and Prof. Umesh Waghmare; December 3-8, 2012.

15. International conference on Design of Biomaterials (BIND-12)", IISc, December 9-11, 2012

16. International conference on "Operator Algebras in Nonequilibrium Statistical Mechanics" at Bambolim Beach Resort, Bambolim, Goa, December 17-21, 2012

17. International Conference on Biomolecular Forms and Functions: A Celebration of 50 Years of the Ramachandran Map, Prof. Manju Bansal, January 8 - 11, 2013

18. International Conference on Quantum Information and Quantum Computing (ICQIQC), Prof. S. Raghuveer, IISc, January 9 - 11, 2013.

19. Annual Conference on Molecular Immunology Forum (MIF), Prof. Ranga Uday Kumar, JNCASR, January 17 - 19, 2013.

20. Indo-US Workshop on "Advanced and Nano-Structured Materials", JNCASR, January 21-22, 2013.

21. Workshop on SQUID magnetometry, Prof. A. Sundaresan, CPMU, JNCASR, Bangalore, January 23, 2013.

22. JNCASR-RMIT Workshop, January 28-29, 2013.

23. Indo-Australia Joint Workshop, January 28-29, 2013.

24. Indo-Israel Conference, January 30-31, 2013.

25. Indo-Canadian Symposium on Nano-Science and Technology ICSNST-2013, Mysore, February 20-22, 2013.

SEMINARS / COLLOQUIA

1. *GTPases involved in Ribosome biogenesis*, Prof Balaji Prakash, IIT, Kanpur, April 2, 2012.

2. *Research activities of St. Petersburg Electrotechnical University "LETI"*, Dr M Odit, St. Petersburg Electrotechnical University LETI, April 6, 2012.

3. *Gene networks in theory and practice*, Dr Mukund Thattai, Computational and Evolutionary Cell Biology, National Centre for Biological Sciences, Bangalore, April 12, 2012.

4. *T Cell Immunobiology in the lung: implications for pulmonary fibrosis*, Dr Sambuddho Mukherjee, Dept. of Cell Biology, Duke University Medical Center, USA, April 12, 2012.

5. *Genome Architecture and Disease*, Dr Tom Misteli, NIH and Editor-in-chief, Journal of Cell Biology, Bethesda, USA, April 13, 2012.

6. *Lecture on LBM*, Dr Santosh Ansumali, JNCASR, Bangalore, April 18, 2012.

7. *Quantum theory of materials: methods and applications*, Dr Manish Jain, Lawrence Berkeley National Laboratory, Department of Physics, University of California, Berkeley, May 1, 2012.

8. *Charge Separation and Recombination in Organic Photoconversion Systems*, Dr. Akshay Rao, Cambridge University, UK, May 2, 2012.

9. *Science Outreach Programme - Summer 2012*, Prof K S Valdiya, JNCASR, May 6 - 9, 2012.

10. *Density controlled bio-functionalized nanostructures*, Dr Loredana Casalis, Sincrotrone Trieste S.C.P.A., Trieste, Italy, May 14, 2012.

11. *Non-normal and nonlinear instabilities in thermo-acoustic interactions*, Prof Sathesh Mariappan, Department of Aerospace Engineering, Indian Institute of Technology Madras, May 23, 2012.

12. *Biomaterials for neural tissue engineering*, Prof. Surya Mallapragada; *Pathogen mimicking nanoparticle for prevention and treatment of respiratory infectious disease*, Prof. Balaji Narasimhan, Department of Chemical and Biological Engineering, Iowa State University, June 14, 2012.

13. *Interplay of 4f-3d interaction and dynamical electrical transport in Sm based manganese oxides*, Prof. R. Mahendiran, Department of Physics, National University of Singapore, June 22, 2012.

14. *Theoretical studies for understanding a few observations on protein conformational dynamics*, Dr. Meher K. Prakash, Co-founder and C.E.O., Metaplastics SAGL, Lugano, Switzerland, June 22, 2012.

15. *Ultracold atoms in the presence of a synthetic gauge field*, Dr. Subhasis Sinha, Physical Sciences Division, Indian Institute of Science Education and Research, Kolkata, July 10, 2012.

16. *ICMS International Materials Lecture*, Prof. Chad Mirkin, Department of Chemistry and International Institute for Nanotechnology, Northwestern University, July 16, 2012.

17. *Molecular adaptation to cold temperatures and high pressure of a psychrophilic cellulase*, Dr. Nushin Aghajari, Senior Scientist, Institute for the Biology and Chemistry of Proteins, July 18, 2012.

18. *Organic Nano-Electro-Mechanical-Sensor Systems for healthcare and Environmental Applications*, Prof. V. Ramgopal Rao, IIT Bombay, July 19, 2012.

19. *Epigenetics of Human Gene Regulation, Steroid Hormone Signaling and Tumorigenesis*, Dr. Subhrangsu S. Mandal, Associate Professor, University of Texas, Arlington, August 3, 2012.

20. *Elephant conservation and human elephant conflict mitigation: playing blind man's buff?* Dr. Prithiviraj Fernando, Centre for Conservation and Research, Srilanka, August 7, 2012.

21. *In search of some novel bimetallic homogeneous and heterogeneous catalysts: from molecular level to nanomaterials*, Prof. Suresh Bhargava, Deputy Pro Vice Chancellor (Int) College of Science, Engineering and Health Head of Advanced materials & Industrial Chemistry School of Applied Sciences, RMIT University, August 10, 2012.

22. *Circadian clock protein Cryptochrome regulates the expression of pro-inflammatory cytokines*, Dr. Rajesh Narasimamurthy, Salk Institute for Biological Studies, USA, August 17, 2012.

23. *Effective Hamiltonians for Excited States of Fluorescent Protein Chromophores*, Prof. Ross H. McKenzie, University of Queensland, Brisbane, Australia, August 17, 2012.

24. *Magnesium Alloy Design: A perspective on multi-scale modeling*, Dr. Amitava Moitra, Fenske Laboratory Department of Chemical Engineering The Pennsylvania State University University Park, USA, August 21, 2012.

25. *Investigation of Local Structure in nano and disordered systems - some recent XAFS results*, Dr. Debdutta Lahiri, High Pressure & Synchrotron Radiation Physics Division, BARC, Mumbai, August 24, 2012.

26. *Mesoscale methods for Extended hydrodynamics*, Dr. Santosh Ansumali, Faculty Fellow, Engineering Mechanics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India, September 4, 2012.

27. *Next-Generation Genomics at C-CAMP - Accelerating the Biological Research in India*, Dr. Malali Gowda, Director, Next-Generation Genomics Facility, C-CAMP, NCBS, Bangalore, September 7, 2012.

28. *Non-local Stokesian hydrodynamics of active filaments*, Dr. Ronojoy Adhikari, The Institute of Mathematical Sciences, Chennai, September 10, 2012.

29. *Partial Decoherence in a Mesoscopic System*, Prof. Sushanta Dattagupta, VisvaBharati University, Shantiniketan, September 14, 2012.

30. *Viral latency and drug resistance in HIV-AIDS*, Dr. Amilkar Tanuri, Molecular Virology Laboratory, Institute of Biology Department of Genetics, UJRF, Reo de Janerio, Brazil, September 14, 2012.

31. *Predicting and explaining phenomena in carbon and boron nitride nanostructures*, Prof. Helio Chacham, Departamento de Fisica, ICEx, UFMG, Brazil, September 17, 2012.

32. *Nanotechnology based assays for detection of blood borne and biodefense pathogens*, Indira Hewlett, Chief, Laboratory of Molecular Virology, Division of Emerging and Transfusion Diseases, Office of Blood Research and Review, Center for Biologics Evaluation and Research (CBER), FDA, MD, September 18, 2012.

33. *Voltage gated ion channels*, Prof. Michael Klein, Institute for Computational Molecular Science, Temple University, Philadelphia, September 27, 2012.

34. *American Association for the Advancement of Science (AAAS) and Science Magazine*, Bill Moran, Global Director of International Collaboration and Custom Publishing, September 27, 2012.

35. *Arora kinases beyond centrosomes: role of transcription factors' phosphorylation in gene expression and cell cycle*, D. Karthigeyan, MBGU Colloquium, November 16, 2012.

36. *Chromosome Stability (JNCASR - IISER, TVM) Meeting*, Prof. Kaustuv Sanyal, JNCASR, December 17 - 19, 2012.

37. *The use of Microfluidics in High-Throughput Single Cell Gene Expression*, Dr. Ramesh Ramakrishanan, Director of Molecular Biology at Fluidigm Corporation, San Francisco, US, October 3, 2012.

38. *Genetic, competitive and behavioural constraints on adaptation*, Prof. Deepa Agashe, NCBS, Bangalore, October 4, 2012.

39. *Modeling Transient Photovoltage Measurements*, Dr. Girish Lakhwani, University of Cambridge, October 5, 2012.

40. *Synthesis of Natural Products, Drugs, Agrochemicals and Materials by Multiple Pd-Catalyzed Transformations*, Prof. Lutz F. Tietze, Institute of Organic and Biomolecular Chemistry, Georg-August-University Gattingen, Tammannstr, Gattingen, Germany, October 5, 2012.

41. *Benefits of cooperation and communication in bacteria*, Professor Sandeep Krishna, Theory and Modelling of Biological Systems,National Centre for Biological Sciences, Bangalore, India, October 9, 2012.

42. *Inorganic nanotubes and fullerene-like nanoparticles*, Prof. Reshef Tenne and Prof. Alla Zak, Weizmann Institute, Israel, October 16, 2012.

43. *Spin polarised transport via Dithienylethene molecule attached to magnetic nickel leads*, Kanchan Ulman & Nisha Mariam, Ph. D Student, TSU, JNCASR, Jakkur Bangalore, October 16, 2012.

44. *Carbon fluids in the deep Earth: insight from ab initio simulations*, Dr. Leonardo Spanu, Shell Corporation, Bangalore, India, October 23, 2012.

45. *Orientational Relaxation in an Ionic Liquid: An All-atom Simulation Study*, Prof. Ranjit Biswas, SNBNCBS, Kolkata, October 26, 2012.

46. *Rotational wave packet imaging of molecules*, Dr. Ramakrishna Sesha Sankar, NorthWestern University, October 30, 2012.

47. *Hybrid quantum dot circuit: carbon nanotubes and ferromagnets*, Dr. Subhadeep Datta, Mesoscopic Physics Group, Laboratoire Pierre Aigrain, Ecole Normale Superieure, Paris, October 31, 2012.

48. *Computational-based Engineering and Vascular Devices and Disease*, Dr. Anamika Prasad, IIT-Patna, Assistant Professor (Adjunct), November 6, 2012.

49. *Objects, space, and memory: how the hippocampal cognitive map comes together*, Dr. Sachin Deshmukh, Assistant Research Scientist, Mind/Brain Institute, Johns Hopkins University, November 6, 2012.

50. *Mechanical Deformation of Amorphous Solids*, Professor Srikanth Sastry, TIFR Centre for Interdisciplinary Sciences, Hyderabad, November 6, 2012.

51. *Stable and accurate numerical methods for computational Cardiology*, Dr. Ishani Roy, King's College London, UK, November 6, 2012.

52. *Are mosquitoes in disease "hot-spots" more efficient vectors? Insights on spatial variation in disease resistance and tolerance in a natural vector-parasite system*, Dr. Guha Dharmarajan, Ramanujan Fellow, IISER Kolkata, November 8, 2012.

53. *The spatial and temporal dynamics of elephant social networks*, Dr. Shermin de Silva, Colorado State University, November 17, 2012.

54. *How do you publish in PRL? Why should you?,* Dr. Samindranath Mitra, Editor, Physical Review Letters, American Physical Society (APS), November 8, 2012.

55. *Guided Self-Assembly of Soft Matter Systems for Membrane Applications*, Manesh Gopinadhan, Yale University, November 23, 2012.

56. *Tissue Repair and Regeneration*, Prof. David Leavesley, Faculty of Health, Queensland University of Technology Australia, November 26, 2012.

57. *Thio-and selenocarbonyls: from Fundamentals to Functional Molecules*, Prof. Toshiaki Murai, Faculty of Engineering, Gifu University, Yanagido, Gifu, Japan, November 26, 2012.

58. *A Novel Regulatory Role of Protein S in Thrombosis and Hemophilia*, Dr. Rinku Majumdar, Department of Biochemistry and Biophysics, University of North Carolina, Chapel Hill, USA, December 4, 2012.

59. *New functions for BLM and RECQL4 helicases during neoplastic transformation*, Dr. Sagar Sengupta, NII, New Delhi, December 6, 2012.

60. *Amyloid beta peptide oligomers in Alzheimer's disease*, Dr. Vijay Rangachari, University of Southern Mississippi, Hattiesburg, December 6, 2012.

61. *Journeys with Macrobicyclic Cryptands*, Prof. Parimal K. Bharadwaj, Department of Chemistry, IIT Kanpur, U.P., India, December 10, 2012.

62. *Epigenomics of Cellular Differentiation: Discovering Fundamental Principles of Transcriptional Regulation*, Dr. Vijay Tiwari, Institute of Molecular Biology gGmbH (IMB), Mainz, Germany, December 10, 2012.

63. *Epigenetic Mechanisms of Mitochondrial Retrograde Signaling and Regulation of Telomere Function*, Prof. Narayan G. Avadhani, Department of Animal Biology, University of Pennsylvania, December 12, 2012.

64. *Efflux pumps in clinical drug resistance, Prof. Rajendra Prasad, School of Life Sciences*, Jawaharlal Nehru University, New Delhi, December 13, 2012.

65. *Reentrant Glass Transition(s?) in Colloidal Ellipsoids and Directional Grain Growth in Sheared Polycrystals*, Dr. Rajesh Ganapathy, ICMS, JNCASR, Bangalore, December 18, 2012.

66. *Understanding Early Steps in DNA Mismatch Repair*, Prof. Eric Alani, Cornell University, USA, December 24, 2012.

67. *Taste detection and behavior in Drosophila*, Dr. Sunanda Marella, Stanford University, Stanford, USA, December 28, 2012.

68. *Does nanotechnology really help, for higher thermal-electrical conversion efficiency, in thermoelectric materials?*, Prabhakar Bandaru, Departments of Mechanical and Aerospace Engineering, Electrical Engineering, and Physics, at UC, San Diego, January 03, 2013.

69. *Direct Synthesis of Carbon Based Nanostructures, Including Studies on the Physics and Chemistry of Fullerides*, Prof. Dr. H. C. Martin Jansen, Max-Planck-Institute for Solid State Research, January 07, 2013.

70. *Alternative Methods of Gene Delivery in Various Animal Models*, Dr. Srinivas Rao, Chief, Laboratory Animal Medicine Vaccine Research Center, National Institute of Health, Bethesda, MD, USA, January 8, 2013.

71. *Role of G9a in differentiation and cell cycle exit of skeletal muscle cells*, Reshma Taneja, Associate Professor, Department of Physiology, University of Singapore, January 8, 2013.

72. *Seismic imaging of the power spectrum of turbulent convection in the solar interior,* Dr. Shravan Hanasoge, Department of Geosciences, Princeton University, Princeton, NJ, USA, January 08, 2013.

73. *Onset of shear flow in confined soft amorphous materials*, Dr. Pinaki Chaudhuri, University of Duesseldorf, Germany, January 09, 2013.

74. *Size-induced shifts in the thermodynamics of nanophase oxides and implications for materials science*, Geochemistry and Environmental Science, Prof. Alexandra Navrotsky, Peter A. Rock Thermochemistry Laboratory and NEAT ORU, UC Davis, January 09, 2013.

75. *Ternary diamond-like semiconductors for high performance thermoelectrics*, Prof. S.D. Mahanti, Department of Physics and Astronomy DOE Energy Frontier Research Center Michigan State University, East Lansing, Michigan, USA, January 15, 2013.

76. *Impact of the Dynamic Cytoskeleton on Intracellular Sub-Diffusion: A Local Motion Analysis*, Amitabha Nandi, University of Yale, January 17, 2013.

77. *Fluctuation and plasticity in foam-flow near jamming*, Dr. Vijayakumar Chikkadi, Weizmann Institute of Science, Israel, January 18, 2013.

78. *How pure water can unmix*?, Prof. Mikhail A. Anisimov, University of Maryland, USA, January 22, 2013.

79. *Mesoscale Solubilization in Aqueous Solutions of Hydrotropes*, Dr. Deepa Subramanian, University of Maryland, USA, January 22, 2013.

80. *Chromosomal movement and biased microtubule growth accelerate mitotic spindle assembly*, Prof. Raja Paul, Indian Association for the cultivation of science, Kolkata, January 30, 2013.

81. *Fluidics at Micro-Nanoscale: Soft Capillarity, Superoleophobicity, Bio-Electrohydrodynamics*, Dr. Siddhartha Das, Banting Postdoctoral Fellow, Department of Mechanical Engineering, University of Alberta , Canada, January 30, 2013.

82. *Quantum Phase Transition of Light: Cavity Quantum Electrodynamics*, Dr. Sujit Sarkar, Poorna Prajna Institute of Scientific Research, Bangalore, India, February 5, 2013.

83. *Proteomic insights into the relationship between cellular iron homeostasis, Fe-S cluster assembly and tumorigenesis*, Dr. Ajay Vashisht, Department of Biological Chemistry, David Geffen School of Medicine, University of California, Los Angeles, USA, February 8, 2013

84. *Organic-based Magnets: New Chemistry and New Materials for this Millennium*, Prof. Joel S Miller, Department of Chemistry, University of Utah, Salt Lake City, UT, USA, February 11, 2013.

85. *Correlation of charge extraction properties and short circuit current in various organic photovoltaic devices*, Dr. Th. Birendra Singh, Materials Science and Engineering Division, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Clayton South, Victoria, Australia, February 12, 2013.

86. *Climate Change From Science to Policy and Actions in the Field*, Prof. Veerabhadran Ramanathan,

Distinguished Professor of Climate Sciences, Scripps Institution of Oceanography, University of California at San Diego, UNESCO Professor of Climate and Policy, TERI University, New Delhi, February 13, 2013.

87. *Cyclic conjugated chemical entities. From molecules to high-tech molecular devices*, Prof. Kamaljit Singh, Prof.. Kamaljit Singh Organic Synthesis Laboratory, Department of Applied Chemical Sciences & Technology, Guru Nanak Dev University, Amritsar, February 14, 2013.

88. *Pathogenic SYNGAP1 haploinsufficiency impairs cognitive development by disrupting the maturation of dendritic spine synapses*, Dr. James Chelliah, Department of Neuroscience, Scripps Research Institute, Florida, USA, February 19, 2013.

89. *Raman Spectroscopy and its applications in biology*, Prof. Chandrabhas Narayana, Chemistry and Physics of Materials Unit, JNCASR, February 19, 2013.

90. *Convection induced by radiative cooling in a layer of participating gas*, Dr. Prasanna Swaminathan, Department of Mechanical Engineering, IIT-Madras, February 20, 2013.

91. *The role of a self-sustaining amyloidogenic protein in persistence of memory*, Dr. Amitabha Majumdar, Stowers Institute for Medical Research, USA, February 21, 2013.

92. *Protein Analogous Micelles: Versatile, Modular Nanoparticles*, Prof. Matthew Tirrell, The Institute for Molecular Engineering, The University of Chicago, February 21, 2013.

93. *Exploring the function of integins in keratinocytes: A tail of 2 kindlins*, Dr. Srikala Raghavan, Institute for Stem Cell Biology and Regenerative Medicine (inStem), NCBS, Bangalore, February 22, 2013.

94. *Lamins and disease: Insights into stability of key proteins*, Dr. Veena Parnaik, Centre for Cellular and Molecular Biology, Hyderabad, February 26, 2013

95. *Mapping Confined Water Molecules to Design New Blockers Against the M2 Proton Channel of the Influenza Virus*, Dr. Giacomo Fiorin, Research Assistant Professor, College of Science & Technology, Institute for Computational Molecular Sciences, Philadelphia, March 05, 2013.

96. *Surprising complexity of human RNA polymerase III transcription*, Dr. Martin Teichmann, Universitae Bordeaux Segalen Institut European de Chimie et Biologie (IECB), March 08, 2013.

97. *Evolutionary Models of Late-Life Demography*, Prof. Laurence D. Mueller, Dept. of Ecology and Evolution, University of California, Irvine, March 20, 2013.

98. *Epigenetics and microRNAs in Inflammation and Diabetic Vascular Disease*, Dr. Rama Natarajan, Endowed Professor and Associate Chair, Department of Diabetes Director, Division of Molecular Diabetes Research Beckman Research Institute of City of Hope, CA, USA, March 26, 2013.

99. *Heterochromatin, epigenetics and age reprogramming*, Dr. Prim Singh, Division of Tumor Biology, Research Center Borstel, Germany, March 28, 2013.

FELLOWSHIPS AND EXTENSION ACTIVITIES

Extension Programmes

Summer Research Fellowship (SRFP)

The advertisement for SRFP 2012 was released in eight major Indian newspapers and posted on JNCASR website. Out of 3015 applications received, 48 were selected and 40 joined this programme. Under this programme, the students receive a scholarship of Rs 6000 per month.

Category	No. of applications Received (for 2012)	No. of Fellowships offered in 2012	No of fellowships utilized in 2012
Life Sciences	850	17	14
Engineering Sciences	515	08	08
Atmospheric Sciences	80	03	03
Physical Sciences	565	08	04
Chemical Sciences	325	08	08
Mathematics	330	03	02
Materials Science	350	01	01
Total	**3015**	**48**	**40**

The advertisement for SRFP 2013 was also released in eight major Indian newspapers and announced on JNCASR website. Out of 1707 applications received, 73 students are selected and are being offered SRFP fellowships this year. The JNC faculty will be guiding 49 SRFP students; and 10 students by few faculty from NCBS and IISc . The remaining 14 are placed under various faculty of institutions outside Bangalore.

Project Oriented Chemical Education (POCE)

Nineteen students of POCE batches of 2010(2010-12) & 2011(2011-13) had worked under different faculty members on various research projects. Nine students who had successfully completed POCE-2010-12 program were awarded Diploma in Chemistry.

Out of nine students who had completed POCE programme, one student- Promit Ray has joined JNCASR for the M.S.-Ph. D programme, two students are doing M.S. in U.S.A/ Germany, whereas six other students are pursuing their studies at institutions in India.

Mr. Promit Ray was awarded the "Best POCE-2010-12 student award". The award was donated by CNR Rao Education Foundation.

Ms. Amritha Rangarajan, student of the POCE batch of 2008 (2008-10) has joined JNCASR for M.S.(Engg.) programme.

Two students (of POCE-2012-14), during their winter vacation, have worked with faculty members.

Advertisement for the year 2013-15 program was released (in January) in 10 leading news papers of the country. 10 candidates have been selected. They are expected to join on 13 May 2013.

Project Oriented Biological Education (POBE)

Advertisement for POBE-2013 was released in 10 newspapers and announced on our website. POBE batches of 2011 and 2012 will return for their training under EOBU and MBGU faculty of the Centre during May 2013 along with the fresh batch.

8 POBE students of 2010 batch received their Diploma certificates in Biology. Many of them are pursuing their MS at institutions in India and abroad. One student from the POBE batch of 2010 has joined JNCASR under the MS-Ph.D programme offered by the Evolutionary and Organismal Biology Unit.

Advertisement for the year 2013-15 program was released (in January) in 10 leading news papers of the country. 10 candidates have been selected. They are expected to join on 13 May 2013.

Visiting Fellowship Programme

Since 2006, 69 fellowships were offered of which and 52 have availed and completed the programme successfully. Eight candidates have been selected to the Visiting Fellowships Programme 2012-13 under the Physical Sciences category and two under the Biological Sciences category.

JNCASR-CICS (Centre for International Cooperation in Science) Fellowship

This Fellowship programme (earlier called as JNCASR-CCSTDS) has been renamed as is jointly instituted by the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) Bangalore and the Centre for International Co-operation in Science (CICS), Chennai to encourage mobility of scientists from developing countries. CICS is a Unit of the Indian National Science Academy (NISA), supported by the Department of Science & Technology, New Delhi. This programme aims to promote co–operation among developing regions.

Two Fellows selected for the year 2009-10 have been given certificates on successful completion of their 3 month training programme in India. 4 Fellows has been given certificates for the year 2010-11. 1Fellow has been awarded certificate for the year 2011-12.

The JNCASR-CICS Fellowship committee met during December 2012 for the selection of Fellowships for the year 2012-13. The Fellowships were awarded to 8 candidates from Nigeria, Yemen, Bangladesh and Armenia.

National Science Day

The Centre celebrated National Science Day on February 28, 2013. On this day, the Centre organized series of lectures for students and teachers from different schools from Bangalore at Prof CNR Rao Hall of Science. There was an overwhelming participation from around 200 students from 4 schools with teachers and students having an interactive session with the scientists after each lecture.

Science Outreach Programmes

CNR Rao Hall of Science-ETU-SOP had conducted *four* two -days workshops on, "Experiments using College Chemistry Kit" for the P. U. Sc. Students (of Govt. College, Brahmavar, Govt. P. U. College Udupi, S. V. P. U. Sc. College, Vidyanagar, Swami Vivekananda Rural P. U. College Aanekal, Swami Vivekananda Youth Movement, Mysore, Maharani Govt. College, Mysore). On completion of the workshop, one Chemistry Kit was donated to each college for future use.

INTELLECTUAL PROPERTY

Innovation ecosystems have become more complex in recent times and are built on flow of ideas amongst innovation contributors from various sectors through national and international collaborations. Public Research Institutions have always played crucial role in providing platform technologies for translation into affordable services/products. To foster generation, protection and management of commercializable intellectual property, the Centre has framed an enabling mechanism through the Intellectual Property Management Committee [IPMC].

During the year, the IPMC reviewed a number of new inventions developed by its researchers and recommended filing of patent applications based on the commercial potential of the invention and the patentability criteria. The Committee approved filing of 21 patent applications (Indian Provisional Application:7, Indian Complete Application: 1, International Patent Application under PCT:6, USA:5, Europe:1, China:1) and obtained 4 US Patents. The details are listed below:

Patent Applications Filed

I. Indian Patent Applications
(a) Provisional applications filed for the inventions of the following inventors:

- Jayanta Haldar, Divakara Siva Sathyanarayana Murthy Uppu, Akkapeddi Padma, Goutham Belagula Manjunath (Appl. No. 2747/CHE/2012, 6/7/2012)
- Ravi Ramchandra Manjithaya (Appl. No. 4080/CHE/2012, 28/9/2012)
- Tapas Kumar Kundu, Parijat Senapati, Gopinath Kodaganur Srinivasachar, Deepthi Sudarshan, Manjula Das, Smitha Pazhoor Kumaran, Manjunath Shivasangappa Devaraman, Ajithkumar Sumitrappa (Appl. No. 4084/CHE/2012, 28/9/2012)
- Chintamani Nagesa Ramachandra Rao, Ujjal Kamar Gautam, Srinivasa Rao Lingampalli (Appl. No. 4195/CHE/2012, 5/10/2012)
- Jayanta Haldar, Chandradhish Ghosh, Padma Akkapeddi (Appl. No. 5299/CHE/2012, 18/12/2012)
- Giridhar Udapi Rao Kulkarni, Kunala Durga Mallikarjuna Rao, Ritu Gupta, Boya Radha and Shanmugam Kiruthika (Appl. No. 954/CHE/2013, 5/3/2013)
- Ranjani Viswanatha, Avijit Saha, Kavassery Sureshwaran Narayan, Kishore Velichappattu Chellapan (Appl. No. 1163/CHE/2013, 18/3/2013)

(b) Completed Application:

Hydrogen Sorbent Materials
Inventors: Subi Jacob George, Kotagiri Venkata Rao
Appl. No. 2287/CHE/2012, 7/6/2012

II. International Patent Application under PCT

Manufacturing Strain Sensitive Sensors And/Or Strain Resistant Conduits From A Metal And Carbon Matrix
Inventors: Kulkarni Giridhar Udapi Rao, BoyaRadha, Abhay A Sagade
Appl. No. PCT/IB2012/052872, 7/6/2012

Artificial Retina Device (Bulk Heterojunction/Electrolyte Polymers As Novel Biocompatible Photoactive Multi Color-Sensing Technology)
Inventors: Kavasssery Sureswaran Narayan, Vini Gautam, Monijit bag
Appl. No. PCT/IB2012/053711, 20/7/2012

Polymer, Methods Of Obtaining The Polymer And Applications Thereof
Inventors: Subi Jacob George, Kotagiri Venkata Rao
Appl. No. PCT/IB2012/055021, 21/9/2012

A System And A Method To Detect Hydrogen Leakage Using Nano-Crystallised Palladium Gratings
Inventors: Giridhar Udapi Rao Kulkarni, Ritu Gupta, Abhay A Sagade
Appl. No. PCT/IB2012/055245, 1/10/2012

An Organic Solar Cell And Methods Thereof
Inventors: Kavassery Sureswaran Narayan, Anshuman Jyothi Das
Appl. No. PCT/IB2012/056338, 12/11/2012

Cationic Antibacterial Composition
Inventors: Jayanta Haldar, Yarlagadda Venkateswarlu, Akkapeddi Padma
Appl. No. PCT/IB2012/056373, 13/11/2012

III. US Patent Applications

(a) Provisional Application:

Solvent-Free Oxidation Of Toluene By Nanoparticles Of Cd And Zn Peroxides Under Favourable Operating Conditions
Inventors: Chintamani Nagesa Ramachandra Rao, Ujjal Kamar Gautam, Srinivasa Rao Lingampalli
Appl. No. 61/733,854, 5/12/2012

(b) Non-Provisional Applications:

Chromophores For Detection Of Volatile Organic Compounds
Inventors: Subi Jacob George, Mohit Kumar
Appl. No. 13/482,9876, 6/6/2012

Julolidine Conjugates And Methods For Their Preparation And Use
Inventors: Govindaraju Thimmaiah, Debabrata Maity, Swapan Kumar Pati, Tapas Kumar Kundu, Arun Kumar Manna, Karthigeyan Dhanasekaran
Appl. No. 13/597,323, 9/8/2012

Graphene Ribbons And Methods For Their Preparation And Use
Inventors: Giridhar Udapi Rao Kulkarni, Narendra Kurra, Abhay A Sagade
Appl. No. 13/599,810, 30/8/2012

Vector, Vector Combinations, Methods And Kit Thereof
Inventor: Ranga Udaykumar
Appl. No. 13/809,758, 11/1/2013

IV. European Patent Application
Vector, Vector Combinations, Methods And Kit Thereof
Inventor: Ranga Udaykumar
Appl. No. 11806381.7, 24/12/2012

V. Chinese Patent Application
Inhibition Of Histone Acetyltransferases By CTK7A And Methods Thereof
Inventors: Tapas Kumar Kundu, Mohammed Arif, Kempegowda Mantelingu, Gopinath Kodaganur Srinivasachar
Appl. No. 201080045291.6, 6/4/2012

Patents Granted

A Mirror Adapted In Microscope To Perform Surface Enhanced Raman Spectroscopy, A Microscope And Methods Thereof
Inventors: Chandrabhas Narayana, Pavan Kumar Gopalapura Venkataramu
USA Patent No. 8,179,525 B2, Granted on 15/5/2012

A High Sensitivity Assay For Molecular Typing Of Biological Sample, Probes And A Kit Thereof
Inventors: Ranga Udaykumar, Chandrabhas Narayana, Jayasuryan Narayana
USA Patent No: 8227590, Granted on 24/7/12

Methods And Compositions For The Separation Of Single-Walled Carbon Nanotubes
Inventors: Chintamani Nagesa Ramachandra Rao, Subi Jacob George, K Venkata Rao, Rakesh Voggu
USA Patent No: 8246928, Granted on 21/8/12

A Template Free, Polymer Free Metal Nanosponge And A Process Thereof
Inventors: Eswaramoorthy Muthusamy, Saikrishna Katla
USA Patent No. 8404280, Granted on 26/3/13

RESEARCH PROGRAMMES

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:

1. Molecular modelling of materials
2. Nanomaterials and catalysis
3. Nanomaterials, nanofabrication, molecular crystals
4. Functional materials based on Metal-Organic Frameworks (MOFs)
5. Organic electronics: device physics & photophysics
6. Raman and Brillouin Spectroscopy, high pressure research in the study of materials
7. Chemistry of materials
8. Epitaxy and nanostructures
9. Magnetism, superconductivity and multiferroicity
10. Granular matter and other complex fluids
11. Mesoscale simulations and high performance computing
12. Instabilities and interfacial flows
13. Aerospace and atmospheric fluid mechanics
14. Fluid mechanics and heat transfer
15. Rheology of complex fluids, vortex dynamics, transport processes in the nocturnal boundary layer
16. Circadian rhythms in fruit flies and ants
17. Evolutionary genetics and population ecology
18. Neuronal circuits in fruitflies
19. Animal behaviour and sociogenetics
20. Neotectonics and environmental geology
21. Aberration corrected transmission electron microscopy
22. Soft materials
23. Physics of soft matter
24. Organic materials and organocatalysis
25. Physics and chemistry of nanomaterials
26. Functional organic and supramolecular materials
27. Organic synthesis, molecular probes, peptide and protein chemistry, nucleic acid chemistry, bionanotechnology
28. Bio-organic and medicinal chemistry
29. Designing new ways to small molecule heterocyclic scaffolds
30. Inorganic and solid state chemistry
31. Nanomaterials and renewable energy

32. Solid state inorganic chemistry
33. Molecular and cellular mechanisms of human genetic disorders
34. Molecular parasitology and molecular enzymology
35. Molecular, genetic and developmental analysis of the cardiovascular system
36. Transcription regulation and chromatin dynamics: implications in disease and potential therapeutics
37. Autophagy and autophagy related pathways
38. Chromatin biology and genomics
39. The HIV-1 subtype-c strain: success story of the fittest viral subtype
40. Genetic and epigenetic definition of Centromeres
41. Mechanisms underlying host-pathogen interactions in malaria
42. Materials theory
43. Statistical physics of equilibrium and non-equilibrium condensed matter systems
44. Mathematical models of biological evolution
45. Novel physics and chemistry at the nanoscale
46. Chemistry and physics of systems ranging from atoms to extended materials
47. Phase transformations and dynamics in soft condensed matter, and biological systems
48. Non-commutative probability and geometry: mathematics of quantum mechanics
49. Correlated electron systems and organic electronics
50. Chemical biology
51. Condensed matter theory

Research facilities

(List of equipments procured during 2012 - 2013)

1. CLARUS 580 Gas chromatograph
2. Thermo Heraeus high-speed table top refrigerated centrifuge and accessories
3. Outdoor chiller unit Model OPC3-K
4. Nikon Trinocular Stereoscopic zoom microscope
5. Thin film deposition monitor
6. REVCO UXF freezer
7. High performance computing system
8. Millipore water purification system
9. Seebech Coefficient measuring apparatus
10. 1500deg.C tube furnace, Adapters, benchtop muffle furnace
11. LFA 457 Microflast laser apparatus
12. Electron beam power supply
13. 1500Deg. Box furnace, thermo couple assay
14. Imaging spectrometer and accessories
15. Spectroflurometer multimode reader
16. Emulsiflex high pressure homogenizer
17. K101 Control coater system and accessories
18. Mbraun Glove box
19. Versa Max TM microplate reader
20. Tata Elxsi HPC Clusters
21. Model VCS750 Ultrasonic processor with accessories
22. Hielscher ultrasonic Sonicator UP-100H
23. PPMS Evercool II system
24. FASTCAM SA4 Model 500k M2 mono high speed imaging system
25. Completely automatic anaerobic chamber
26. AMD Servers and accessories
27. Glove box simulators with accessories
28. Sheldon Anaerobic chamber and incubator
29. Absorption reflection spectrophotometer
30. Atomic Layer deposition system
31. Quantel lasers

32. Research grade Lambda 750 UV VIS NIR
33. Q2000 MDSC System
34. Rudolph Density Meter DDM2911
35. Vibration controller with accessories
36. Modular compact Rheometer MCR302 with PIV cell
37. MCOSM Multi gas incubator
38. Cryosystem 2000 with accessories
39. Empyrean Alpha-1 XRD System with accessories
40. HPC System
41. AMD Server with 6380CPU
42. AMD Server

SPONSORED / ONGOING RESEARCH PROJECTS

S.No.	Project	Project Investigator	Funding Agency	Duration
1	Post doctoral fellowship in Nano-Science and Technology	Co-ordinated by JNCASR	DST	cont.
2	Unit on Nano-Science & Technology-UNANST - DST	Co-ordinated by JNCASR	DST	-
3	Training and research facility for human embryonic stem and human embroynic carcinoma cells	Prof. Manisha Inamdar & Prof.MM Panikar	DBT	-
4	DAE-SRC Outstanding Research Investigator Award to Prof. Anuranjan Anand. Project title "Whole Genome-based Studies to Identify Novel Molecular Genetic Pathways Causing Human Epilepsy Syndrome"	Prof. Anuranjan Anand	DAE	5 years
5	J.C. Bose Fellowship	Prof. M.R.S. Rao	DST, JCB	5 years
6	Delineating viral determinants of HAD using SCID mice	Prof. Ranga Uday Kumar	AECOM	cont.
7	Structure function analysis of Tumor suppressor, p53 interacting proteins: structural basis of p53 activation	Prof. Tapas Kumar Kundu	DBT	-
8	Development of triclosan for treating human malaria and inhibitors of fatty acid synthesis especially enoyI-ACP reeducates of as anti-malarial agents	Prof. Namita Surolia	DBT	4 years
9	Bhatnagar Fellowship -2005 Award to Prof. K.B. Sinha; Project title: "Quantum mechanics - a Mathematical tool to study non-equilibrium processes and dissipative systems in physical sciences, Geometry and information theory"	Prof. K.B. Sinha	CSIR	5 years
10	Investigation of Lift and Thrust in Asymmetric Fight	Prof. K.R. Srinivas	DST	-
11	Functional Genomics based approach to Novel anti-malarial targets and agents	Prof. Namita Surolia	ICMR	-

S.No.	Project	Project Investigator	Funding Agency	Duration
12	JNC-Brucker Sophisticated X-ray diffraction facilities	Co-ordinated by JNCASR	BRUKER, AXS	-
13	NMITLY Project on "Mesoscale modeling for monsoon related weather predictions - Phase II"	Prof. Deshpande S.M.	CSIR	-
14	Swarnajayanthi Fellowship	Prof. S. Balasubramanian	DST	5 years
15	Development of TKFMG solver and its application to flutter prediction in turbo machines	Prof. Deshpande S.M.	GTRE	3 years
16	Density functional theory calculations	Prof. Umesh V. Wagmare	P&G	1 year
17	Chromatin Biology: Epigenomics of chromatin and chromatin remodelling during male germ cell differentiations and glioma progression	Prof. M.R.S. Rao	DBT	5 years
18	Ramanujan Fellowship	Dr. TNC Vidya	DST	5 years
19	India-Japan co-operative programme (DST-JST) 2007 - joint Project entitled "Feasibility study on the application of multiple order parameters in materials to information processing"	Dr. Sundaresan (Dr. Y. Tanka, - NIAIS, Japan)	DST-JST	3 years
20	ICPC NanoNet Coordination and support action	Prof. G.U. Kulkarni	ICPCNN	cont.
21	Swarnajayanthi Fellowship	Prof. Swapan K. Pati	DST	5 years
22	Numerical simulation of multiscale supersonic flows with low dissipative shock capturing schemes	Prof. S.M. Deshpande	DST	2 years
23	Bovine Mastitis: Unraveling molecular details of host microbe interaction and development of molecular diagnostic methods	Prof. Tapas Kumar Kundu	ICAR	3 years
24	Ramanujan Fellowship	Dr. Sheeba Vasu	DST	5 years

S.No.	Project	Project Investigator	Funding Agency	Duration
25	Extended applications of Highly Sensitive Nanometal Raman substrates, Paper based Nano Silver/Gold SERS Substrates (Plain Substrates, Au/Ag metal sponge based SERS Substrates), Specialised Substrates Bio-Chip, Nano silver - Antibacterial Products	Prof. G.U. Kulkarni, Prof. Hemalatha Balalaram, Prof. M. Eswaramoorthy	YNL	1 year
26	Ramanujan Fellowship	Dr. Santosh Ansumali	DST	5 years
27	DAE-SRC Outstanding Research Investigator Award for R/P "Multi scale modeling and simulations of functional Materials"	Prof. Umesh V. Waghmare	DAE	5 years
28	DAE-SRC Outstanding Research Investigator Award for R/P "Electronic, optoelectronics and photonic properties in soft matter and device exploration"	Prof. K.S. Narayan	DAE	5 years
29	MoU between BARC and JNCASR "Development of Test Facility for Thermal Hydraulics studies/Basic research Salt Water/FineHydrogen Bubble Test Facility for simulation of Hydrogen Transport - Management/ Fire safety behaviour/ Containment thermal hydraulics/pollution dispersion studies"	Prof. Meheboob Alam	BARC	3 years 5 months
30	Understanding pathogenesis of Malaria and strategies to treat it	Prof. Namita Surolia	DBT	3 years
31	Indo-Italian research Project: "Designing Novel Photosystems for Enhanced charge Transfer efficiency: A detailed theoretical modeling"	Prof. Swapan K. Pati, JNCASR; Prof. Anna Painelli, Univ. degli studi, ITALY	DST	3 years
32	Indo-US joint networked R&D centre on "Nanomaterials for Energy"	Co-ordinated by Prof. G.U. Kulkarni & Prof. Timothy S. Fisher, BNC, Purdue University, USA	IUSSTF	cont.

S.No.	Project	Project Investigator	Funding Agency	Duration
33	Indo-US joint Research Centre of Excellence in "Advanced Materials Research"	Co-ordinated by Prof. Swapan K. Pati & Vinayak P. Dravid, North-Western Univ., IL, USA	IUSSTF	3 years
34	Role of multifunction human histone chaperone NPMI in transcription and stress associated chromatin dynamics: Relevance in cancer manifestation	Prof. Tapas Kumar Kundu	DBT	3 years
35	IBM Faculty Award 2009	Prof. Umesh V. Waghmare	IBM	cont.
36	Indo-Italian Research Project:"Innovative catalytic patterns for nanowire growth"	Prof. G.U. Kulkarni	DST	3 years
37	India-European Union Research Project "MONAMI Modeling of Nano-scaled Advanced Materials Intelligently"	Prof. Srikanth Sastry	DST	3 years
38	Lineage specification and differentiation from single embryonic stem cells tracked by live cell imaging of reporter gene expression	Prof. Maneesha S. Inamdar	DBT	3 years
39	Optimization of the performance of DNA vaccine by engineering molecular strategies: use of HIV-1 tat as model antigen	Prof. Ranga Udaykumar	ICMR	3 years
40	Examination of the metabolic fate of fumarate a TCA cycle intermediate in Plasmodium falciparum	Prof. Hemalatha Balaram	DST	3 years
41	Analysis of conserved functions of rudhira in development, homeostasis and lifespan	Prof. Maneesha S. Inamdar	DBT	3 years
42	Structure-function studies on Plasmodium falciparum and Methanococcus jannaschii guanosine monophospate (GMP) synthetase:enzymes with ammonia channels	Prof. Hemalatha Balaram	DBT	3 years
43	Dominance Relationships in Female Asian Elephants	Dr. TNC Vidya	CSIR	3 years

S.No.	Project	Project Investigator	Funding Agency	Duration
44	National Bioscience Award for career development 2008; project entitled "Towards isolation of a novel gene for non-syndromic hearing loss at the 11p14.2-q12.1 locus"	Prof. Anuranjan Anand	DBT	3 years
45	Optimization of wing for RTA-70	Prof. R. Narasimha	NAL	1 year
46	INSA Senior Scientist	Prof. H. Ila	INSA	5 years
47	Vision Group on Science & Technology, Govt. of Karnataka	Co-ordinated by JNCASR	VGST	-
48	"Evaluation of molecular and immune status of the blood lymphocytes of subject who participated in the Siddha Clinical Trial CTRI/2008/091/000021" at JNCASR	Prof. Ranga Udaykumar	DST	1 year
49	Developing new synthetic routes for the preparation of unnatural amino acids and their use as metal (Bio-) sensors and chiral ligands in the asymmetric catalysis	Dr.T. Govindaraju	DST	3 years
50	Design, development and establishment of experimental facility at NPOL for studies on internal wake and wave fields generated by self propelled bodies in stratified water medium	Prof. K.R. Srinivas	NPOL	1 year
51	Experimental studies on the generation of internal wakes by the motion of self propelled under water bodies in stratified water medium and their characteristics: Observations measurements with visualization techniques and optical probes	Prof. K.R. Srinivas	NPOL	1 year
52	Evaluation of host immune responses to the Tat antigen of HIV-1 in the Indian clinical cohorts	Prof. Ranga Udaykumar, Co-PI: Dr. Suniti Solomon, Director, YRGC for AIDS, Res. And Edun., Chennai	DBT	3 years
53	Mechanisms of Chikungunya virus disease: mouse model, virulent and fitness determinants and the development of novel therapeutics	Prof. Ranga Udaykumar, JNCASR, Co PI: Prof. Shobha Broor, Dept. of Microbiology AIIMS, New Delhi	DBT	3 years
54	Ramanujan Fellowship	Dr. Rema Krishnaswamy	DST	5 years

S.No.	Project	Project Investigator	Funding Agency	Duration
55	Swedish Research Links Programme entitled "Computational studies of the electronic, magnetic and transport properties of interfaces for nanospintronics applications.	Prof. Shobhana Narasimhan	SRC	cont.
56	Targheed delivery of anti-retrovirals using stealth immunoliposomes	Prof. Ranga Udaykumar	ICMR	3 years
57	Indo-Spanish Joint Programme of cooperation in S&T entitled "Synthesis and properties of nitride-based nanomaterials"	Prof. A Sundaresan	DST	3 years
58	Analysis of asrij in Drosophila hematopoiesis and immunity	Prof. Maneesha S. Inamdar	DST	3 years
59	First-principles determination of thermal properties in nano-structured hexagonal solids with doping modifications for thermal energy harvesting	Prof. Umesh V Waghmare	AOARD	1 year
60	J C Bose Fellowship	Prof. Tapas Kumar Kundu	DST	5 years
61	Ramanujan Fellowship	Dr. Subir Kumar Das	DST	5 years
62	Ramanujan Fellowship	Dr. Jayanta Haldar	DST	5 years
63	Ramanujan Fellowship	Dr. Sebastian C Peter	DST	5 years
64	Development of Novel biodegradable surface coatings for biomedical application	Dr. Jayanta Haldar	DST	3 years
65	Development of Meshless Solver, Point Clouds and preprocessor in Computational Fluid Dynamics (CFD)	Prof. S.M. Deshpande	NAL	3 years
66	Study of conformation and conformational dynamics of some conducting polymers in their neutral and doped forms using vibrational spectroscopy and quantum chemical methods	Dr. Abhishek Kumar Mishra CCMS, JNCASR	DST	3 years
67	India-European Union (EU) research project entitled " ATHENA Advanced theories for functional oxides: New routes to handle the devices of future"	Prof. Umesh V Waghmare	DST	3 years

S.No.	Project	Project Investigator	Funding Agency	Duration
68	Plasfalsyn Structure/Function studies of plasmodium falciparum GMP synthetase	Prof. Hemalatha Balaram	DBT	3 years
69	Indo-Brazil Megaproject entitled " to decipher biological processes of organisms causing diseases of clinical importance in both the countries" (1) Profiling of FAS genes in populations of Plasmodium sp. In the Amazonian region Brazil; (2) Electron microscopy characterization of the intracellular traffic pathway of Apicoplast proteins in falciparum and Toxoplasma gondii and Relationship between the endoplasmic reticulum and the Anicoplast (3) Effect of drugs interfering with FAS biosynthesis pathway on Toxoplasma gondii, Trypanosoma cruzi and Leishmania	Prof. Namita Surolia	DST	3 years
70	Indo-Brazil Megaproject entitled " to decipher biological processes of organisms causing diseases of clinical importance in both the countries" (1) Determination of the structure of Plasmodium falciparum proteins involved in the purine nucleotide synthesis by X-ray crystallography	Prof. Hemalatha Balaram	DST	3 years
71	India-Japan research project: "Hematopoeitic Stem Cell Differentiation: Role of SAM Biosynthesis Arginine Methylation and p53	Prof. Tapas Kumar Kundu	DST	2 years
72	Advancing the Efficiency and Production Potential of Excitonic Solar cells (APEX)	Prof. K.S. Narayan	DST	3 years
73	DAE-SRCH Outstanding Research Investigator Award for the project titled "Dynamics and patterns in granular fluid: Theory and experiment"	Prof. Meheboob Alam	DAE	3 years
74	Synthetic Investigation Heterocyclic scaffolds	Prof. H. Ila	CSIR	3 years
75	Alloy development and mechanical behaviour	Prof. Umesh V Waghmare	GEGR	2 years
76	Swedish Research Links Programme: "Multiplexed immune and DNA-based diagnosis of tuberculosis"	Prof. Chandrabhas Narayana	SRL	3 years
77	INDO-IRAN Collaborative Programme in "Nano cience & Technology" at ICMS, JNCASR	Prof. C.N.R. Rao & Prof. G.U. Kulkarni	DST	3 years
78	India-South Africa thematic sub-project entitled "HIV Vaccine Immunogen Design: Identification of T-cell epitopes associated with control of viral replication in Indian and South African"	Prof. Ranga Udaykumar	DST	3 years

S.No.	Project	Project Investigator	Funding Agency	Duration
79	Understanding the Parasexual cycle of a hybrid formed between two asexual human pathogens candida albicans and Candida dubliniensis: A novel way to identify virulence factors	Dr. Kaustuv Sanyal	CSIR	3 years
80	Ramanujan Fellowship	Dr. Ujjal K Gautam	DST	5 years
81	Welcome Trust - DBT India Alliance award to Dr. Ravi Manjithaya; an Intermediate Fellowship entitles: Small molecule modulators of autophagy and autophagy related pathways	Dr. Ravi Manjithaya	WT-DBT	5 years
82	Identification of DNA replication origins and origin binding proteins of the human pathogen, Candida albicans	Prof. Kaustuv Sanyal	DBT	3 years
83	Theoretical Studies of molecular imprinted polymers for the detection of explosives and toxic gases	Prof. Balasubramanian S	NMRL-DRDC	3 years
84	Innovative Young Biotechnologists Award to Dr. T. Govidaraju; project entitles: "Development of Biomimetic Materials as substitutes for Natural Fibers using Designed Modular Peptides	Dr. T. Govindaraju	DBT	3 years
85	MoU between SHELL and JNCASR entitles: To develop and validate a predictive method for modelling physical properties of hydrocarbons	Prof. Balasburamanian S	SHELL	2 years
86	Indo-Finland collaboration on biotechnology titled: Innovative concept for infectious disease diagnostics	Prof. Ranga Uday Kumar, JNCASR & Dr. Swaminathan, RGP Lab.ICGEB, New Delhi	DBT	2 years
87	India-European Union (EU) research project Organic and Organic-Inorganic hybrid solar Cells: Optimization of Materials Properties, Bulk Heterojunction Morphology and Device Efficiencies (OISC/LARGECELLS)	Prof. G.U. Kulkarni	DST	3 years
88	Women Scientist Scheme A entitles: Computational studies on structural, mechanistic and spectroscopic characterization of lignocellulosic materials salvation and photosystem I charge/energy transfer processes	Dr. Ganga Periyasamy	DST	3 years
89	Studies on the physiological basis of maternal effects due rearing density in Drosophila melanogaster	Dr. B M Prakash	DST	3 years

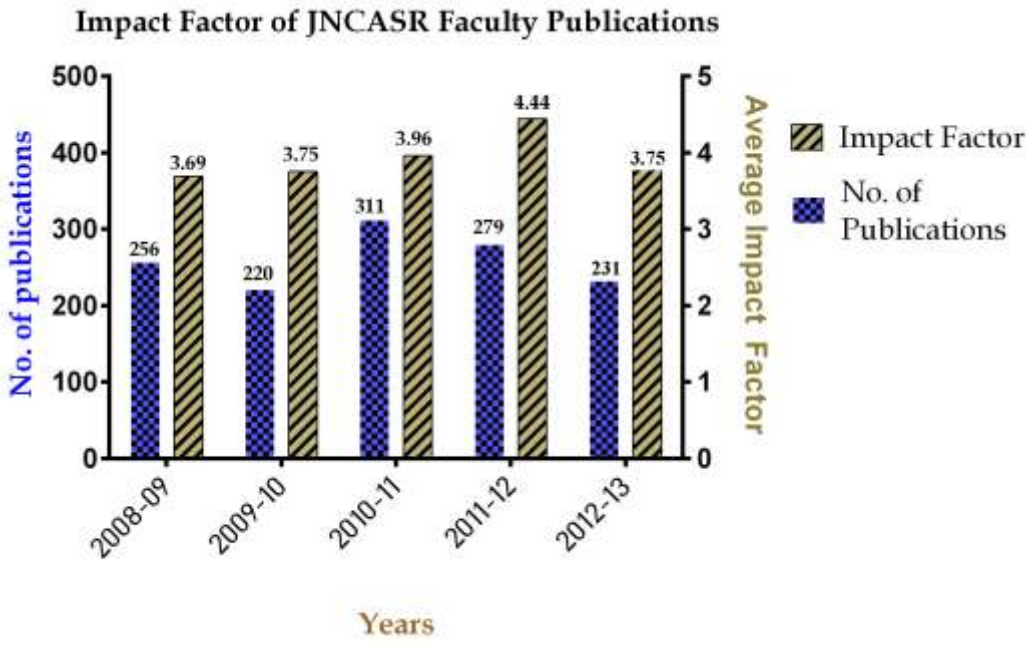
S.No.	Project	Project Investigator	Funding Agency	Duration
90	Programme support on chromatin and disease (Chromatin dynamics and transcription regulations: Implications in disease and therapeutics	Prof. Tapas Kumar Kundu Co-PI: Prof. Ranga Udaykumar	DBT	5 years
91	MoU between JNCASR and NCI (Nippon Chemical Industrial Co. Ltd.) on project “Develop inorganic nanomaterials for drug release”	Prof. M Eswaramoorthy	NCI	-
92	"Targeting protein lysine acetylation in oral cancer and neurodegenerative disorders using nanomaterials”	Prof. Tapas Kumar Kundu & Prof. Eswaramoorthy M	DBT	3 years
93	Analysis of conserved pathways involved in maintaining homeostasis and survival in mammals and Drosophila	Prof. Maneesha S Inamdar	WT	3 years
94	Thematic Unit of Excellence on Nanochemistry at JNCASR	Coordinated by Prof. G.U. Kulkarni	DST	5 years
95	Estimating the lift in flapping flight for the design of Entompter/MAV	Prof. K.R. Sreeenivas	ADE	3 years
96	Numerical Simulation of cloud flow and mixing layers	Prof. R. Narasimha	INTEL	1 year
97	Aerodynamic shape optimization	Prof. S.M. Deshpande	INTEL	1 year
98	Grid-based libraries	Dr. Santosh Ansumali	INTEL	1 year
99	MoU between JNCASR & Raja Ramanna Centre for Advanced Technology on " High Pressure XRD Measurement System”	Prof. N. Chandrabhas	RRCAT	1 year
100	J.C. Bose Fellowship	Prof. Amitabh Joshi	SERB	5 years
101	Ramanjujan Fellowship	Dr. Kanishka Biswas	SERB	5 years
102	Thematic Unit of Excellence on "Computational Materials Science" at JNCASR	Proj. Co-ordiator Prof. S. Balasubramanian	DST	5 years
103	Development and evaluation of active polymer nanocomposite packaging materials for food contact applications	Prof. G.U. Kulkarni	DFRL	1 year
104	Indo-Brazil S&T Cooperation of Joint Project: Pathogenic and molecular characterization of HIV-1 from diverse tissues and body fluids of subjects characterized with HIV associated dementia and other neurologic manifestations	Prof. Ranga Udaykumar	DST	5 years

S. No.	Project	Project Investigator	Funding Agency	Duration
105	“Structure-property relations in RE2TGe3 (RE=rare earths; T=transition metals) compounds (CRS-M-166)”	Dr. Sebastian C Peter	UGC	3 years
106	Rare earth doped chalcogenide glasses for optical and photonic applications	Dr. Sebastian C Peter	SERB	3 years
107	Regulation of Chromatin Associated proteins by miRNAs: Implications in Breast Cancer	Prof. Tapas Kumar Kundu	DBT	3 years
108	Structure-function analysis of centromeres of a pathogenic budding yeast candida tropicali	Prof. Kaustav Sanyal	DBT	3 years
109	Pulsed Laser Desposition (PLD) growth of ZnO BCN and study their properties from atomic scale imaging and spectroscopic techniques	Dr. Ranjan Datta	SERB	3 years
110	Indo-Italian Project entitled: From Small Molecules to Advanced Molecular Materials: Transport and Transfer Properties	Prof. Swapan K Pati	DST	3 years
111	MoU between AOARD, USA & JNCASR "The Feasibility of producing field effect transistor structures by utilizing the effect of donor/acceptor organic molecules when they are physisorbed onto a graphene surface and modulation of the electronic properties of graphene by various metal and semiconducting nanoclusters”	Prof. Swapan K Pati	AOARD	2 years
112	"Numerical Investigations of Unsteady aerodynamics in insect Flight”	Prof. Sunderesan A	ADE	3 years
113	Reprogramming somatic cells to model cardiovascular differentiation for research and therapeutic potential	Prof. Maneesha Inamdar	DBT	3 years
114	Analysis of factors regulating self renewal and differentiation to aid generation of lineage restricted stem cells/progenitors for cell replacement therapy	Prof. Maneesha Inamdar & Prof. Hemalatha Balaram	DBT	3 years
115	MoU between JNCASR & HPCL "Development of Microbial catalysts (Biocatalysts) for Fermentative Butanol Production”	Dr. Ravi Manjithaya	HPCL	2 years
116	"Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory"	Prof. Tapas Kumar Kundu	IFCPAR	3 years
117	CSIR Centre of Excellence in Chemistry at JNCASR	Prof. C.N.R. Rao	CSIR	5 years
118	Collaborative projects between JNCASR/ICMS & DST	Prof. C.N.R. Rao	DST	-

S.No.	Project	Project Investigator	Funding Agency	Duration
119	DNS of Turbo-Machinery Blading	Prof. Roddam Narasimha	GTRE	2 years
120	Collaboratitve Programme between DRDO and JNCASR	Prof. C.N.R. Rao	DRDO	5 years

PUBLICATIONS

The Centre has registered a very good progress in its publications. A chart showing the year-wise publication and the impact factor thereof is appended below:



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20. Sarma, D. D.; Santra, P. K.; Mukherjee, S.; Nag, A., X-ray Photoelectron Spectroscopy: A Unique Tool To Determine the Internal Heterostructure of Nanoparticles. ***Chemistry of Materials*** **2013 (Feb 14)**, *25* (8), 1222-1232, http://dx.doi.org/10.1021/cm303567d

21. Mangalam, M.; Singh, M., Sex and physiological state influence the rate of resource acquisition and monopolisation in urban free-ranging dogs, Canis familiaris. ***Behaviour*** **2013** *150* (2), 199-213, http://dx.doi.org/10.1163/1568539x-00003045

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23. Roy, K.; Singh, M.; Singh, M., Estimation of Resource Availability with Special Reference to Nonhuman Primates in a Rainforest Region in the Central Western Ghats, South India. ***Proceedings of the National Academy of Sciences India: Section B: Biological Sciences*** **2013 (22/03/2013)**, http://dx.doi.org/10.1007/s40011-013-0173-y.

24. Kumar, P.; Sathyamurthy, N., An ab initio quantum chemical investigation of the structure and stability of ozone-water complexes. ***Chemical Physics*** **2013 (Mar 29)**, *415* (0), 214-221, http://dx.doi.org/10.1016/j.chemphys.2013.01.008

BOOK CHAPTER BY HON. PROFESSOR/HON. FACULTY

1. Gadagkar, R. (2012). The Luxury of Introspection. In: Über das Kolleg hinaus - Joachim Nettelbeck, dem Sekretär des Wissenschaftskollegs 1981 bis 2012 (Beyond the college - Joachim Nettelbeck, the Secretary of the Wissenschaftskollegs from 1981-2012) (Eds.) Diawara, M.; Günther, K., and Meyer-Kalkus, R., Wissenschaftskolleg zu Berlin, Germany, pp. 152-157.

AWARDS / DISTINCTIONS

Prof. C N R Rao

Honoris Causa D.Sc from University of Kerala

Honoris Causa D.Sc. degree from the University of St. Andrews (degree to be awarded in Sept 2013)

2012 Award for International Cooperation by The Chinese Academy of Sciences.

Prof. Roddam Narasimha

Padma Vibhushan (Govt. of India)

Year-of-Science Professorship, DST, Govt. of India

Semi-annual lecture series titled '*The Roddam Narasimha Distinguished Seminar Series*', instituted at IIT Gandhinagar out of an endowment made by Prof. A. V. Anilkumar, Vanderbilt University, USA. The first lecture in the series was given on 16 April 2013.

Prof. M M Sharma

Hari Om Ashram Sr Scientist Award, PRL Ahmadabad

Honorary Doctor of Science, I I T-Kharagpur

Indian Chemical Council(formerly Indian Chemical Manufacturers Association) Life-time Achievement Award

Institute of Chemical Technology, Mumbai -Super Star, in 80th year of the institute

AcSIR Academy Professor

Prof. G. U. Kulkarni

Bangalore Nano National Award, 2012

Prof. Tapas K Kundu

Ranbaxy Research Award, 2011 (Medical Sciences – Basic Research)

First prize of India Innovation Award, Merck Millipore company

Prof. S.M. Shivaprasad

Dr. Raja Ramanna Science and Technology Award for Science and Education from Karnataka State Council for Science & Technology - 2013

Prof. Swapan K. Pati

TWAS Prize in Chemistry, 2012

Prof. Umesh Waghmare

India Citation Award 2012 from Thomson Reuters.

Prof. Kaustuv Sanyal

National Bioscience Award for Career Development 2012 from the Department of Biotechnology, Government of India.

Prof. Tapas Kumar Maji

CRSI Bronze Medal, 2013

NASI-Scopus Young Scientist Awards for the year 2012 in Chemistry

Prof. Meheboob Alam

C. N. R. Rao Oration Lecture Award (2013)

Dr. Subi J. George

MRSI Medal, 2013

Prof. Govindan Rangarajan

Platinum Jubilee lecture at the Indian Science Congress.

Prof. Raghavendra Gadagkar

Sir M.Visvesvaraya Senior Scientist State Award, Government of Karnataka, 2011 (awarded in 2013).

Mr. Nadiger Nagaraj

The Most Valuable Staff Member prize, 2012

Mr. Sachin S Belvadi

Young Achievers Award 2012 by KKS Social Welfare Trust

AWARD RECEIVED BY STUDENTS

Ms. Nisha Mammen (Ph.D. student, TSU; Research Supervisor: Prof. Shobhana Narasimhan) received the Best Poster prize at the 2nd Gordon Research Conference on Noble Metal Nanoparticles, held at Mt. Holyoke College, USA.

Ms. Sharmila Narendra Shirodkar, (Ph.D. student, Materials Theory Group, TSU; Research Supervisor: Prof. Umesh Waghmare) receives "The Malhotra Weikfield Foundation - Bangalore Nano Young Scientist Award".

Mr. M. Shivaprasad (Ph.D. student, Bioorganic Chemistry Lab, NCU; Research Supervisor: Dr. T. Govindaraju) awarded "Best Poster" prize at Chennai Chemistry Conference (CCC 2013).

Mr. Jiaul Hoque (Ph.D. student, Bio-organic and Medicinal Chemistry Laboratory, NCU; Research supervisor: Dr. Jayanta Haldar) was awarded the best poster award in The first International Conference on Emerging Technologies for Clean Water-2012 at IITM, Chennai.

Mr. Yarlagadda Venkateswarlu (Ph.D. student, Bio-organic and Medicinal Chemistry Laboratory, NCU; Research supervisor: Dr. Jayanta Haldar) was awarded best poster award :

- by The Chemical Research Society of India at the Mid year meeting 2012, at CDRI, Lucknow.
- at the International Conference on "Current Trends in Drug Discovery Research-2013" (CTDDR-2013).

Dr. Jeelan Basha, (Research Associate, Transcription and Disease Laboratory, MBGU) has received best poster award in the "International symposium on chemistry and chemical biology of natural products" (CCBNP-2012) held at Indian Institute of Chemical Technology (IICT), Hyderabad during 2-4, August 2012.

ACS Chemical Biology recognizes **Mr. Dhanasekaran Karthigeyan** (Ph.D. student, Transcription and Disease Laboratory, MBGU; Research supervisor: Prof. Tapas Kumar Kundu) for "best poster" presented in the "International Symposium on Challenges in Chemical Biology-2013".

RAK-CAM Sheikh Saqr Junior Fellowship has been awarded to **Mr. Rana Saha** (Ph.D. student, CPMU; Research supervisor: Prof. A. Sundaresan and Prof. C.N.R. Rao)

MEMBERSHIPS / APPOINTMENTS

Prof. C.N.R. Rao

Einstein Professor of Chinese Academy of Sciences 2012
Erudite Visiting Professorship from Mahatma Gandhi University, Kottayam
Academy Professor, Academy of Scientific & Innovative Research 2013.

Prof. M R S Rao

Honorary Visiting Professorship of Department of Biochemistry, I.I.Sc

Prof. Roddam Narasimha

Hon. Distinguished Professor, ISRO
Academy Professor of AcSIR (Academy of Scientific and Innovative Research)

Prof. M M Sharma

Academy Professor of AcSIR (Academy of Scientific and Innovative Research)

Prof. K. Vijay Raghavan

Appointed as *Secretary* to Department of Biotechnology, Govt. of India.

Prof. Raghavendra Gadagkar

Member, German National Academy of Sciences Leopoldina, 2012.
Chairman, Advisory Board of Council of Scientific and Industrial Research (CSIR), March 2013 – February 2016.
Member, TWAS Regional Prize – 2013 in the subject area "Public Understanding and Popularization of Science".
Member, Advisory Board, Australian Section of the International Union for the Study of Social Insects (IUSSI), Cairns, 2014.
Ex-officio Member, National Committee, International Union of Biological Sciences (IUBS), 2012-2015.

Prof. Meheboob Alam

Visiting Professorship Award (2013), by Yukawa Institute for Theoretical Physics, Kyoto University, Japan

Dr. Sebastian C. Peter

Memberships – ACS, CRSI, ASM, MRSI, IUC

EDITORIAL BOARDS

Dr. Jayanta Haldar

Editorial Board Member of the Journal 'Microbial Pathogenesis', published by Elsevier

Dr. Ranjan Datta

Editorial board member of 'Journal of Solid State Physics' published by Hindawi Publishing Corporation

Dr. Kanishka Biswas,

Editorial Board Member of the Journal 'Materials Science in Semiconductor Processing', published by Elsevier.

Prof. N. Satyamurthy

Reappointed as Editor, European Journal of Physics D (2013-2015).

FELLOWSHIPS

Prof. P Rama Rao

Fellowship of National Academy of Engineering, USA

Prof. K B Sinha

Elected as Emeritus Scientist of Indian Statistical Institute, Kolkata

Prof. Shobhana Narasimhan

Indo-Australia Senior Scientist Visiting Fellowship for the year 2012-2013 by INSA.

Prof. G. U. Kulkarni

Sheikh Saqr Senior Fellow, 2012

Prof. Chandrabhas Narayana

Fellow of the NASI, Allahabad.

Prof. S Balasubramanian

Fellow of Indian Academy of Sciences, Bangalore, 2012

Prof. Swapan K. Pati

DST J C Bose Fellowship from DST, Govt. of India (2013-2018).

Prof. Vijay Kumar Sharma

Fellow of Indian Academy of Sciences, Bangalore, 2012

Fellow of INSA, New Delhi

Prof. Umesh Waghmare

DST J C Bose Fellowship

Prof. Tapas Kumar Maji

TWAS Young Affiliateship, 2012-2017

Sheikh Saqr Fellow, 2012

Prof. Ganesh Subramanian

2012-2013 Fulbright-Nehru Fellowship for Senior Researchers

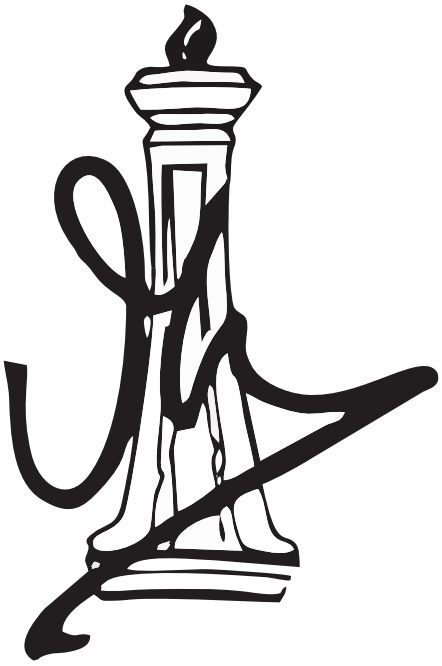
Dr. Ranjan Datta

Associate of Indian Academy of Sciences

Dr. Ravi Manjithaya

DBT Welcome Trust Fellowship

FINANCIAL STATEMENTS



Name	:	**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**
Address	:	**JAKKUR POST, BANGALORE - 560 064**
Year Ended	:	**31ST MARCH 2013**
Assessment Year	:	**2013-14**

AUDITOR'S REPORT TO THE MEMBERS OF THE GOVERNING BODY OF JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

We have audited the accompanying financial statements of Jawaharlal Nehru Centre For Advanced Scientific Research("The JNCASR") which comprise the Balance Sheet as at March 31,2013 and the Income and Expenditure account for the year ended on that date , and a summary of significant accounting policies and other explanatory information annexed there to.

Management's responsibility for the financial statements

Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position and financial performance and drawn up in prescribed forms as suggested by Department of Science & Technology of Government of India and are in conformity with the generally accepted accounting principles in India. This responsibility includes the design, implementation and maintenance of internal control relevant to preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement whether due to fraud or error.

Auditor's responsibility

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. Those standards require that we comply with the ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedure selected depends on the auditor's judgment including the assessments of risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal controls relevant to the JNCASR's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes assessing the accounting principles used and significant estimates made by management as well as evaluating the overall financial statements presentation. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the financial statements have been drawn up in prescribed forms under the Department of Science & Technology of Government of India, and are in conformity with the generally accepted accounting principles in India and give a true and fair view Subject to Notes forming part of the accounts and our comments & observations:

i) In the case of Balance Sheet, of the state of affairs of the entity as at March 31, 2013, and

ii) In the case of Income and expenditure account, of the excess of expenditure over the income for the year ended on that date.

Report on other legal and regulatory requirements

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit.

2. In our opinion proper books of accounts as required by law have been kept by Jawaharlal Nehru Centre for Advanced Scientific Research so for as it appears from our examination of those books.

3. The Balance Sheet, Income and Expenditure Account and Receipts and Payment account dealt with by this report are in agreement with the books of account.

4. The Balance Sheet and Income and Expenditure Account dealt with by this report are prepared in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India subject to the following observations:

a) Non-Provisions of accrued liability in respect of leave encashment which is not in conformity with the Accounting, Standard 15 [Accounting for retirement benefits in the financial statements of Employers] issued by the Institute of Chartered Accountants of India. [Refer Note No. 3 of Schedule No. 24]

b) The amount spent on acquisition of fixed assets has been deducted from the total grants/ subsidies received in the Income & Expenditure account. This is not in conformity with the Accounting Standard – 5 issued by the Institute Of Chartered Accountants of India. It has been explained that this format has been consistently used to present the accounts before the authority who grant the funds.

for P V PRABHU & CO
Chartered Accountants

Sd/-
(NAGARAJA)
Partner
M No. 205345

Place : Bangalore
Date : 16.09.2013

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
BALANCE SHEET AS AT 31st MARCH 2013

Description	Schedule	Current Year	Previous Year
		2012-13	2011-12
		Rs.	Rs.
LIABILITIES			
Corpus/Capital Fund	1	1,948,737,679.32	1,748,078,797.32
Reserves & Surpluses	2	(22,611,981.80)	36,041,572.19
Earmarked and Endowment Funds	3	253,237,801.82	218,031,724.82
Secured loans and Borrowings	4	-	-
Unsecured loans and Borrowings	5	-	-
Deferred Credit Liabilities	6	-	-
Current Liabilities and Provisions	7	38,401,186.43	29,029,543.04
Other funds-Cluster Studies		39,541.00	39,541.00
Scheme Balances		235,334,009.46	258,230,931.46
Total		**2,453,138,236.23**	**2,289,452,109.83**
ASSETS			
Fixed Assets (gross)	8	1,948,737,679.32	1,748,078,797.32
Investments-Endowment Funds	9	247,984,117.00	265,447,196.00
Investment - Others	10	-	-
Current Assets, Loans, Advances etc.	11	256,416,439.91	275,926,116.51
Total		**2,453,138,236.23**	**2,289,452,109.83**
Significant accounting policies	24		
Contingent Liabilities & Notes on Accounts	25		

Schedule 1 to 25 form integral part of Accounts

For Jawaharlal Nehru for Advanced Scientific Research

This is the Balance sheet referred to in our report of even date.

for P V PRABHU & CO
Chartered Accountants

Sd/-
(NAGARAJA)
Partner
M No. 205345
ICAI. F.R. No. 050121S

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

Sd/-
R.S. Gururaj
Accounts Officer

Place : Bangalore
Date : 16.09.2013

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH 2013

Description	Schedule No	Current Year 2012-13 Rs.	Previous year 2011-12 Rs.
Income			
Income from services	12	0.00	0.00
Grants/Subsidies received	13	512,800,000.00	532,124,049.00
		512,800,000.00	**532,124,049.00**
Less: Extent of fixed assests procured		200,733,882.00	191,507,778.78
		312,066,118.00	**340,616,270.22**
Add:Proceeds of sale of fixed assets		75,000.00	1,750,543.00
		312,141,118.00	**342,366,813.22**
Income from Fees/Subscriptions etc	14	1,582,050.00	1,370,677.00
Income from investments	15	0.00	0.00
Royalty Income,Publication,Licence fee etc	16	2,985,697.05	1,133,297.69
Interest earned	17	7,207,828.00	6,549,486.00
Other income	18	44,389,619.21	37,595,352.97
Increase/decrease in stocks	19	0.00	0.00
Total		**368,306,312.26**	**389,015,626.88**
Expenditure			
Establishment expenses	20	202,993,769.00	183,487,959.00
Other administrative expenses	21	203,522,861.25	157,781,920.03
Expenditure on Grants,Subsidies etc	22	0.00	0.00
Interest & bank charges	23	154,192.00	45,791.00
Total		**406,670,822.25**	**341,315,670.03**
Excess of income over expenditure		-38,364,509.99	47,699,956.85
Balance brought forward		**36,041,572.19**	**3,341,615.34**
		-2,322,937.80	**51,041,572.19**
Transferred to Corpus Fund Account		20,289,044.00	15,000,000.00
Balance carried to Balance sheet		**(22,611,981.80)**	**36,041,572.19**
Significant accounting policies (Enclosed)	24		
Contingent Liabilities & Notes on Accounts	25		

Schedule 1 to 25 form integral part of Accounts

For Jawaharlal Nehru for Advanced Scientific Research

This is the Income & Expenditure Account referred to in our report of even date.

for P V PRABHU & CO
Chartered Accountants

Sd/-
(NAGARAJA)
Partner
M No. 205345
ICAI. F.R. No. 050121S

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

Sd/-
R.S. Gururaj
Accounts Officer

Place : Bangalore
Date : 16.09.2013

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31.03.2013

OPENING BALANCES & RECEIPTS	2012-13 Rs Ps	2011-12 Rs Ps	PAYMENTS & CLOSING BALANCES	2012-13 Rs Ps	2011-12 Rs Ps
I. Opening Balances:			**I. Expenses :**		
a. Cash in hand & Imprest at centre	221,661.00	713,613.00	a.Establishment Expenses	202,993,769.00	183,487,959.00
			b.Administrative Expenses	203,522,861.25	157,781,920.03
b. Bank balances:			c.Expenditure of endowments	2,470,822.00	2,445,760.00
In Savings Bank Accounts :				**408,987,452.25**	**343,715,639.03**
At Canara bank	7,270,018.65	22,769,251.69	**II. Payment made against funds for various projects :**		
At Union Bank of India	161,751.00	155,663.00		0.00	0.00
At SBI	80,901.00	486,759.00			
			III. Investments and Deposits made :	0.00	0.00
In Deposit Accounts					
At IDBI bank					
At HDFC trust	47,005,500.00	34,325,000.00	**IV. Expenditure on Fixed assets and Capital Work-in-progress :**		
At GOI Bonds(SHCIL & SBI)	0.00	11,700,000.00	a. Purchase of fixed assets	200,733,882.00	191,507,778.78
At Canara Bank	217,408,000.00	124,388,000.00			
	272,147,831.65	**194,538,286.69**			
II. Grants Received:					
From DST-Grant in aid	490,200,000.00	532,000,000.00	**V. Refund of surplus money /Loans :**	0.00	0.00
From Govt agencies	16,600,000.00	0.00	**VI. Finance charges (Bank charges) :**	154,192.00	45,791.00
From other agencies	6,000,000.00	124,049.00			
On behalf of Endowments	2,366,370.00	12,957,248.00			
	515,166,370.00	**545,081,297.00**			
III. Income on Investments from:					
A. Interest on FD's:					
a.From Earmarked/Endowment Funds	14,184,564.00	16,863,067.10			
b.From Own funds	4,499,757.00	3,083,929.00			
	18,684,321.00	**19,946,996.10**			
IV. Interest received:					
a. On Bank S.B A/c	2,708,071.00	2,431,861.00			
Balance Carried Forward	**808,706,593.65**	**761,998,440.79**	**Balance Carried Forward**	**609,875,526.25**	**535,269,208.81**

Contd. ...

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31.03.2013 (contd.)

OPENING BALANCES & RECEIPTS	2012-13 Rs Ps	2011-12 Rs Ps	PAYMENTS & CLOSING BALANCES	2012-13 Rs Ps	2011-12 Rs Ps
Balance Brought Forward	**808,706,593.65**	**761,998,440.79**	**Balance Brought Forward**	**609,875,526.25**	**535,269,208.81**
V. Other Income :			**VII. Other payments :**		
a.Royalty	2,904,764.05	789,456.69	Earnest money deposit returned	0.00	514,840.00
b.Licence Fee	80,933.00	343,841.00	Staff advances	0.00	1,301,199.00
c.Collections from Visitors, Guest room etc	4,082,132.00	2,786,860.00	Caution money deposit returned	0.00	0.00
d. from fee,subscription etc	1,582,050.00	1,370,677.00	TDS on interest	1,558,263.00	0.00
e. CSIR fellowships,SRFP reimbersements	23,561,441.00	21,417,220.00	Other advances given	0.00	6,521,807.40
f. Overhead recoveries	16,000,000.00	12,500,000.00	Payment to sundry creditors	0.00	0.00
g. From services	0.00	0.00		**1,558,263.00**	**8,337,846.40**
h.From others	746,046.21	891,272.97			
	48,957,366.26	**40,099,327.66**			
			VIII. Closing Balances :		
			a. Cash in hand & Imprest at centre	68,826.00	221,661.00
			b. Bank balances:		
VI. Amount borrowed :	0.00	0.00	*In savings bank accounts :*		
			Canara Bank	8,615,603.05	7,270,018.65
VII. Other receipts :			Union Bank of India	168,304.00	161,751.00
From disposal of fixed assets	75,000.00	1,750,543.00	State Bank of India	1,729,686.00	80,901.00
Income tax refunds	0.00	1,389,862.00	*In deposit accounts :*		
From Sundry creditors	8,851,628.39	10,516,713.41	At Canara Bank	103,908,000.00	217,408,000.00
Other advances recovered	1,007,995.00		At SHCIL	61,500,000.00	
Earnest money received	11,110.00	0.00	At HDFC Trust	80,705,500.00	47,005,500.00
Recoveries from current assets	520,015.00	0.00			
	10,465,748.39	**13,657,118.41**		**256,695,919.05**	**272,147,831.65**
TOTAL	**868,129,708.30**	**815,754,886.86**	**TOTAL**	**868,129,708.30**	**815,754,886.86**

This is the Receipts and payment account referred to in our report of even date.

for P V PRABHU & CO
Chartered Accountants

Sd/-
(NAGARAJA)
Partner
M NO. 205345
ICAI.F.R.No.050121S
Place : Bangalore, Dated: 16.09.2013

For Jawaharlal Nehru for Advanced Scientific Research

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

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
CPF & NPS FUND STATEMENT OF AFFAIRS FOR THE YEAR ENDED 31.03.2013

Particulars	Rs.	Rs.	Particulars	Rs.	Rs.
CONTRIBUTORY PROVIDENT FUND			**INVESTMENT OF FUNDS :**		
SUBSCRIPTION :			**Investments in :**		
Opening Balance		39,005,634.00	Government of India 8 % Bonds (SHCIL)	18,500,000.00	73,100,000.00
Add :Subscriptions received during the year	5,912,811.00				
Loan repayments	3,038,390.00		Fixed Deposits at Canara Bank	19,100,000.00	
Interest on subscriptions	3,530,258.00	12,481,459.00	Fixed Deposit at HDFC	35,500,000.00	
		51,487,093.00			
Less: Loans granted during the year	3,790,415.00		Closing Cash and Bank Balance :		
Less: Amount transferred to NPS					
Less: Withdrawals on retirement/death	667,611.00	4,458,026.00	**Cash at Bank :**		
Closing Balance		47,029,067.00	SB A/C No.17513		
			Canara Bank,IISc branch		3,315,804.87
CONTRIBUTION					
Opening balance		30,275,367.00	TDS GOI Bonds (2012-13) receivable		148,000.00
Add : Contribution during the year	2,656,881.00		TDS GOI Bonds (previous year) receivable		586,492.00
Interest on total contributions	2,658,759.00	5,315,640.00			
		35,591,007.00	Due to be remitted to bank on account		
Less: payments during the year	311,630.00		of short payment during 2007 08		179.00
Closing Balance		35,279,377.00			
			Cheque related to March 2013 issued		
NEW PENSION SCHEME			but realised on 02.04.2013		969,331.00
SUBSCRIPTION			Subscription relating to Nov 2012 not paid		497,565.00
Opening Balance		7,039,922.00			
Add : Transfer from CPF					
Add :Subscriptions received during the year	475,350.00				
Interest on subscriptions	166,460.00	641,810.00			
		7,681,732.00			
Less : Transfer to NSDL on A/c of NPS		7,434,748.00			
Closing Balance		246,984.00			
CONTRIBUTION			**Accrued interest on Deposits :**		
Opening balance		6,409,579.00	On Fixed deposits with Canara Bank		1,194,270.00
Add : Contribution during the year	475,350.00				
Interest on total contributions	144,964.00	620,314.00			
		7,029,893.00			
Less : Transfer to NSDL on A/c of NPS		6,810,463.00			
Closing Balance		219,430.00	Balance deficit		2,963,216.13
Total		82,774,858.00	**Total**		82,774,858.00

for Jawaharlal Nehru Centre for Advanced Scientific Research

for P V PRABHU & CO
Chartered Accountants

Sd/-
(NAGARAJA)
Partner
M NO. 205345
Place : Bangalore, Dated: 16.09.2013

Sd/-
R.S.Gururaj
Accounts Officer

Sd/-
Prof.M.R.S.Rao
President, JNCASR

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedule forming part of the accounts

Description	2012-13	2011-12
	Rs. Ps.	Rs. Ps.
SCHEDULE 1- Capital Fund:		
Balance as at the beginning of the year	1,748,078,797.32	1,558,321,561.54
	1,748,078,797.32	**1,558,321,561.54**
Less : Depreciation up to the end of previous year	436,659,498.28	366,473,463.28
	1,311,419,299.04	**1,191,848,098.26**
Add : Addition to Fixed Assets during current year	200,733,882.00	191,507,778.78
	1,512,153,181.04	**1,383,355,877.04**
Less : Deletion to Fixed Assets during Current Year	75,000.00	1,750,543.00
	1,512,078,181.04	**1,381,605,334.04**
Less : Depreciation for the current year	79,301,520.00	70,186,035.00
	1,432,776,661.04	**1,311,419,299.04**
Add : Depreciation Reserve per contra	515,961,018.28	436,659,498.28
TOTAL	**1,948,737,679.32**	**1,748,078,797.32**
SCHEDULE 2- Reserves And Surpluses:		
General Reserve:		
Surplus In Income and expenditure Account	**-22,611,981.80**	**36,041,572.19**
SCHEDULE 3- Earmarked / Endowment Funds:		
A : Infrastructure Corpus Fund		
Opening Balance	155,909,088.64	128,460,673.54
Additions during the year	20,289,044.00	15,000,000.00
Funds-Income from Investments made	11,889,508.00	12,448,415.10
Total : Infrastructure Corpus fund	**188,087,640.64**	**155,909,088.64**
B : Other funds		
Opening Balance of the Funds	62,122,636.18	53,253,044.18
Add : Additions :		
Funds/Donations/Grants/Royalties	2,366,370.00	7,516,200.00
Funds-Income from Investments made	3,131,977.00	3,799,152.00
	67,620,983.18	**64,568,396.18**
Less : Funds-utilisation/Expenditure incurred	2,470,822.00	2,445,760.00
Total : Other Funds	**65,150,161.18**	**62,122,636.18**
Grand Total - Infrastructure Corpus and Other Funds	**253,237,801.82**	**218,031,724.82**
SCHEDULE 4-Secured Loans And Borrowings:	-	-
SCHEDULE 5-Unsecured Loans And Borrowings:	-	-
SCHEDULE 6-Deferred Credit Liabilities:	-	-
SCHEDULE 7- Current liabilities and provisions:		
Sundry Creditors EMD	1,662,004.00	1,141,989.00
Sundry Creditors for others	36,739,182.43	27,887,554.04
TOTAL	**38,401,186.43**	**29,029,543.04**

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2012-13	2011-12
SCHEDULE 8- FIXED ASSETS	**Rs. Ps.**	**Rs. Ps.**
Land - Free Hold	17,715,351.00	17,715,351.00
Buildings :		
General	87,833,491.26	81,638,128.26
Hostel Building	15,660,055.00	15,660,055.00
New Lab Building - AMRL	25,930,339.00	25,930,339.00
Animal House	6,787,344.00	6,787,344.00
Staff Housing	4,319,353.00	4,319,353.00
ETU Building	3,091,348.00	3,091,348.00
Engineering Mechanics Unit Block	7,426,272.00	7,426,272.00
Other buildings like extn to Hostel, College etc.,	11,883,626.00	11,883,626.00
Nano Science Block	7,042,909.00	7,042,909.00
Extensions to Pauling Building - Biology Block	4,766,109.00	4,766,109.00
Dining Hall & Kitchen Block	12,404,330.00	12,404,330.00
Radio Active Lab	203,233.00	203,233.00
International Centre for Materials Science	48,077,623.00	48,077,623.00
Lecture Hall & Academic Block	9,636,712.00	9,636,712.00
Hostel Phase II	19,552,377.00	19,552,377.00
STP Building	291,699.00	291,699.00
Hostel Phase III	27,501,103.00	27,501,103.00
International House	23,142,418.00	23,142,418.00
CNR Rao Hall of Science	10,186,569.00	10,186,569.00
Extensions to HIV lab	1,016,085.00	1,016,085.00
Security Office Block	742,632.00	742,632.00
Animal House - Additional Block	8,292,632.00	8,292,632.00
Residential Quarters (Sr. AO)	3,659,034.00	3,629,170.00
Child Care Centre	728,827.00	728,827.00
New Biology Lab	25,934,842.00	25,900,635.00
Hostel Phase IV	19,424,005.00	19,424,005.00
SCADA - DG Room	240,660.00	240,660.00
President's Residence	7,080,951.00	4,457,440.00
Visiting Students Hostel	32,137,685.00	25,451,063.00
Health Centre	3,243,422.00	3,049,882.00
Nano Institute, Shivanapura	3,709,242.00	3,364,466.00
EOBU Lab block	8,540,395.00	-
Post-Doc Housing-Srirampuram	1,300,000.00	-
Materials Science Lab Block	29,218,163.00	2,980,155.00
	471,005,485.26	**418,819,199.26**
Infrastructure Facilities:		
Roads, Streetlights, Drainage, partitions etc	89,956,110.32	84,377,350.32
Tubewells and water supply	248,912.00	248,912.00
	90,205,022.32	**84,626,262.32**
Plant/Machinery/Equipment:		
Scientific Equipments/Plant/Machinery	683,904,888.45	617,526,236.45
ICMS-Laboratory equipments & facilities	183,569,588.00	142,472,753.00
Equipments - Chemistry & Physics of Materials	74,041,456.00	74,041,456.00
	941,515,932.45	**834,040,445.45**
Others :		
Vehicles	2,703,373.00	2,018,246.00
Furniture and fixtures	61,286,739.87	53,919,958.87
Office equipment	15,851,946.41	12,220,675.41
Computer/peripherals	67,612,223.00	61,007,190.00
Electrical installations	112,738,560.00	112,738,560.00
Library Books	26,926,539.21	25,566,902.21
Library Journals	133,486,405.80	123,807,031.80
	420,605,787.29	**391,278,564.29**
Intangible Assets:		
Software	7,690,101.00	1,598,975.00
TOTAL	**1,948,737,679.32**	**1,748,078,797.32**
Less - Depreciation up to the end of previous year	436,659,498.00	366,473,463.28
Depreciation for the current year	79,301,520.00	70,186,035.00
Written down value of the assets as at the year end	**1,432,776,661.32**	**1,311,419,299.04**
Add - depreciation reserve per contra	515,961,018.00	436,659,498.00
TOTAL	**1,948,737,679.32**	**1,748,078,797.04**

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

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedule forming part of the accounts

Description	2012-13	2011-12
	Rs. Ps.	Rs. Ps.
SCHEDULE 9- Investments - Earmarked/Endowment Funds		
Long Term Deposits		
Fixed Deposits with HDFC Trust	80,705,500.00	47,005,500.00
Govt of India 8% Savings Bonds 2003 [SHCIL & SBI]	103,908,000.00	217,408,000.00
Fixed Deposits with Canara bank	61,500,000.00	0.00
Interest accrued on Fixed Deposits with banks	1,870,617.00	1,033,696.00
TOTAL	**247,984,117.00**	**265,447,196.00**
SCHEDULE 10- Investments - Others		
Short Term Deposits - SCHEMES	-	-
TOTAL	**-**	**-**
Schedule 11 Current Assets, Loans, Advances etc.,		
Cash & Bank Balances (Schemes)		
Cash in hand - Schemes Account	55,672.00	11,723.00
Cash at Bank -Schemes - Canara Bank	2,053,282.46	5,937,148.46
Interest accrued on FD	3,225,055.00	3,582,060.00
Fixed deposit with Canara Bank (Schemes)	230,000,000.00	248,700,000.00
	235,334,009.46	**258,230,931.46**
Cash & Bank Balances - Centre		
Cash in hand at Centre	38,354.00	166,189.00
Cash at Bank - Canara Bank	8,615,603.05	7,270,018.65
Cash at Bank - Union Bank	168,304.00	161,751.00
Cash at Bank - SBI	1,729,686.00	80,901.00
Imprest balance	30,472.00	55,472.00
	10,582,419.05	**7,734,331.65**
Loans and Advances		
Advances to staff	644,120.00	1,652,115.00
Other advances & Receivables	7,430,581.40	7,441,691.40
TDS receivable	2,283,370.00	725,107.00
Amount receivable from Income Tax Department	141,940.00	141,940.00
	10,500,011.40	**9,960,853.40**
TOTAL	**256,416,439.91**	**275,926,116.51**

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedule forming part of the accounts

Description	2012-13	2011-12
	Rs. Ps.	Rs. Ps.
SCHEDULE 12-Income from sales / services	0.00	0.00
	0.00	**0.00**
SCHEDULE 13-Grants/subsidies :		
Grants - DST	490,200,000.00	532,000,000.00
Grants - From Governement agencies	16,600,000.00	0.00
Grants - From other Institutes	6,000,000.00	0.00
Grants - Other international agencies	0.00	124,049.00
TOTAL	**512,800,000.00**	**532,124,049.00**
SCHEDULE 14-Income from Fee/Subscriptions etc :		
Income from fee, subscriptions,medical contribution etc.,	1,582,050.00	1,370,677.00
TOTAL	**1,582,050.00**	**1,370,677.00**
SCHEDULE 15-Income from investments:	**0.00**	**0.00**
SCHEDULE 16-Royalty Income,Publication,Licence fee etc :		
From Royalty	2,904,764.05	789,456.69
Licence fee	80,933.00	343,841.00
TOTAL	**2,985,697.05**	**1,133,297.69**
SCHEDULE 17-Interest earned:		
From Term deposits	4,499,757.00	4,117,625.00
From SB acounts with nationalised banks	2,708,071.00	2,431,861.00
TOTAL	**7,207,828.00**	**6,549,486.00**
SCHEDULE 18-Other income:		
From Visitors house,Guest rooms,Students residense etc,	4,082,132.00	2,786,860.00
CSIR Fellowships, ICMS, SRFP reimbursement etc,.	23,561,441.00	21,417,220.00
Overhead recoveries	16,000,000.00	12,500,000.00
From others(tender fee & other fee collected)	746,046.21	891,272.97
TOTAL	**44,389,619.21**	**37,595,352.97**
SCHEDULE 19 - Increase / Decrease in stock:	-	-

Sd/-

R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedule forming part of the accounts

Description	2012-13	2011-12
	Rs. Ps.	Rs. Ps.
SCHEDULE 20- Establishment expenses:		
Salaries & Scholarship to students	144,888,858.00	134,021,801.00
Wages	39,473,208.00	33,517,514.00
Allowances (Medical reimbursements etc.,)	7,003,149.00	8,594,319.00
Bonus	221,240.00	206,069.00
Contribution to CPF	2,656,881.00	2,715,736.00
Contribution to new Pension Sceme	2,941,969.00	1,716,955.00
Contribution to Group Gratuity Scheme	1,500,000.00	1,500,000.00
Leave Encashment Benefits	258,746.00	328,671.00
Retirement & Terminal Benefits	1,128,603.00	0.00
LTC	2,921,115.00	886,894.00
TOTAL	**202,993,769.00**	**183,487,959.00**
SCHEDULE 21- Other Administrative expenses		
Electricity & Power	40,922,192.00	25,673,910.00
Water charges	5,565,111.00	5,427,788.00
Insurance	565,663.00	469,859.00
Repairs & Maintenance	38,785,984.00	29,434,199.00
Rents, Rates & Taxes	687,833.00	1,227,280.00
Vehicles Running & Maintenance	7,167,385.00	5,291,803.00
Postage, Telephone & Communication	5,416,472.00	6,182,408.00
Printing & stationery	6,754,251.64	4,812,810.24
Travelling and conveyance	6,627,980.00	7,354,701.00
Expneses on Seminars/workshops/discussion meetings	8,543,600.73	7,319,821.51
Membership & Subscriptions	414,794.00	318,026.00
Fees towards Training etc.,	769,351.00	105,274.04
Professional charges	10,805,498.00	4,937,304.00
Laboratory Consumables	48,776,565.00	38,037,529.60
Frieght Inwards	2,365,412.00	2,592,415.00
Other Consumables	2,334,326.00	539,546.00
Advertisement & Publicity	2,935,832.00	4,191,869.00
Other miscellaneous expenses	2,283,998.38	2,322,192.64
Statutory Audit fee	56,180.00	56,180.00
POBE & POCE prgramme	1,576,978.50	635,863.00
Summer Research Fellowship Programme	533,843.00	919,610.00
Fellowships - Department of Bio-Technology	-	27,262.00
ICMS - Workshops, Schools etc,.	1,050,254.00	2,094,776.00
ICMS - Visitor Programmes (National & International)	735,081.00	281,716.00
ICMS - Recurring Expenses	4,582,181.00	4,456,747.00
ICMS - Scientists & Supporting Staff	3,266,095.00	2,701,825.00
Fellowship & Honorarium to visiting Students & Scientists	-	369,205.00
TOTAL	**203,522,861.25**	**157,781,920.03**
SCHEDULE 22-Expenditure on grants, subsidies Etc:	-	-
SCHEDULE 23- Interest and Bank charges:	154,192.00	45,791.00
TOTAL	**406,670,822.25**	**341,315,670.03**

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

SCHEDULE - 24

Accounting Policies :

1. The fixed assets are stated at cost. The Centre has identified depreciation on Fixed Assets, and since they are created out of Grant in Aid funds, they have been classified the same in the statement of affairs under Capital Fund and also under Fixed Assets schedule respectively.
2. Grants received and utilised for procurement of Fixed Assets have been reduced from the total grants received in the Income and Expenditure Account and the same have been included under the Capital Fund Account.
3. The leave encashment to the staff members is accounted as and when it is paid.
4. Investments of the Centre are stated at cost.
5. The foreign currency transactions are translated at the rates prevailing on the date of transaction.
6. Previous years figures have been regrouped and reclassified to read in conformity with the current year's figures.
7. The Centre has put in to 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.
8. Royalty income has been accounted as and when received.
9. The Expenditure listed under Schedule 20 as Establishment Expenses include the salaries paid to Faculty, Scientific and Research Personnel. The Expenditure listed under the Schedule 21 as Administrative Expenses include the expenses towards Laboratory Consumables and Seminar/Workshops/Discussion meetings exclusively incurred for Research purposes.
10. In respect of fluctuation in foreign currencies on account of procurement of fixed assets are not separately shown. However, capitalized in the value of fixed assets.

for P V PRABHU & CO
Chartered Accountants

Sd/-
R.S. Gururaj
Accounts Officer

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

Sd/-
(NAGARAJA)
Partner
M No. 205345
ICAI. F.R. No. 050121S

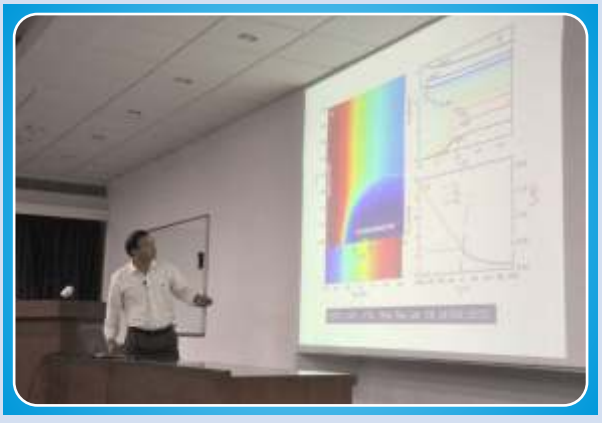
Place : Bangalore
Date : 16.09.2013

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedule forming part of the accounts

SCHEDULE - 25

A. Contingent Liabilities :	2012-13	2011-12
	Rs	Rs
1. Claims against the entity not acknowledged as debts	NIL	NIL
2. Letter of credit outstanding	NIL	NIL
B. Notes on Accounts :		
1. Estimated amount of contracts remaining to be executed on capital account and not provided for.	NIL	NIL

Sd/-
R.S.Gururaj
Accounts Officer



DAE - Raja Ramanna Lecture in Physics : Prize lecture - "*Novel electronic phenomena at oxide interfaces*", by Prof. R.C. Budhani, Director, National Physical Laboratory, 28th September 2012.

Prof. V. Ramalingaswami Memorial Lecture : "*Act of observation and cancer biology*", speaker : Prof. R.A. Badwe, Director, Tata Memorial Centre, Mumbai, 9th July 2012.

The **Kannada Book 'NANO PRAPANCHA'** has bagged the Awards for Excellence in Publishing from the Federation of Indian Publishers.

Visit of Delegation from Riken, Japan

The College Chemistry Kit prepared by CNR Rao Hall of Science and Education Technology Unit along with Science Outreach Programme was distributed to more than 100 Pre - University College Teachers

Q 2000 Modulated Differential Scanning Calorimeter (MDSC)
System installed at Chemistry and Physics of Materials Unit.

Corridor near Lecture Hall, Main Building

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH, Jakkur, Bangalore - 560 064
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