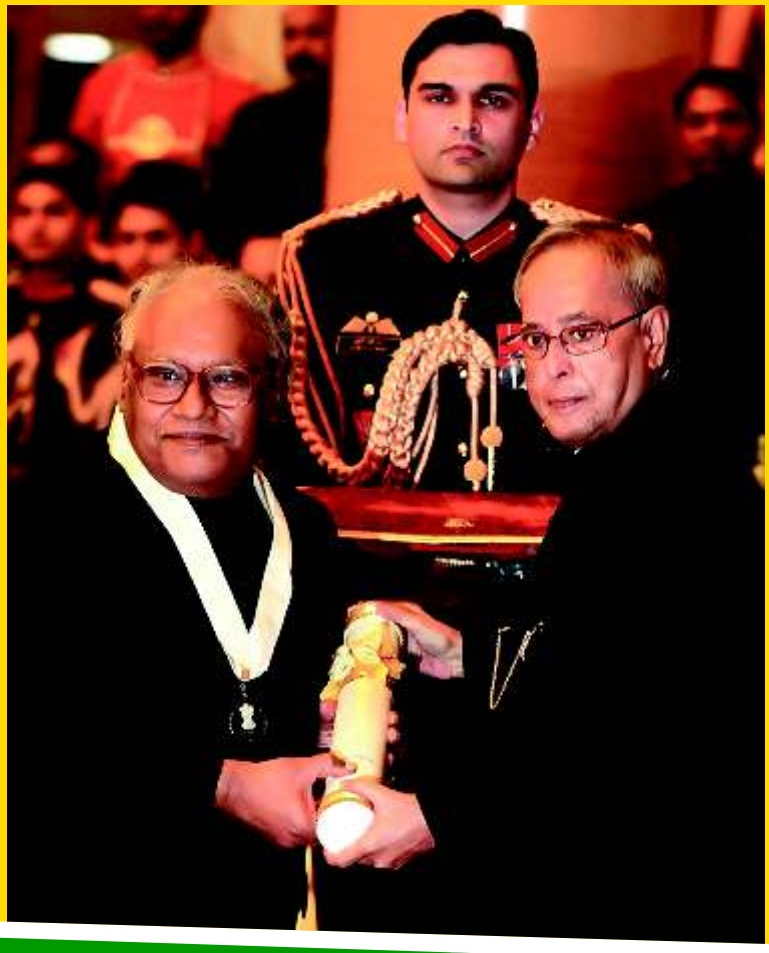
Jawaharlal Nehru Centre for Advanced Scientific Research



Annual Report
2013-2014

SILVER JUBILEE EVENTS

Prof. CNR Rao being feliciated by Dr. Ramasami, Secretary, DST, for being chosen for Bharat Ratna during inauguaration of Silver Jubilee In-house Symposium, November 18, 2013

Prof. CNR Rao delivering Silver Jubilee Inaugural Lecture at Silver Jubilee In-house Symposium at JNCASR, November 18, 2013

Poster presentations by students during Silver Jubilee In-house Symposium

Sarod Recital at the musical consort for Silver Jubilee Celebration on November 18, 2013.

OTHER EVENTS

Speaker of A.V. Rama Rao Memorial Lecture in Chemistry, Prof. Sourav Pal, Director, CSIR-National Chemical Laboratory, Pune on April 29, 2013

Visit of Mr. Jaipal Reddy, Hon'ble Minister of Science and Technology, at JNCASR on June 15, 2013

Prof. Meheboob Alam delivering CNR Rao Oration Award Lecture 2013 on July 07, 2013

Distribution of degrees to students by Prof. MRS Rao, President, JNCASR on July 07, 2013

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ANNUAL REPORT

2013-14

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

(A Deemed to be University)

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

CONTENTS

The Centre

Foreword

I have great pleasure in presenting the Twenty Fifth Annual Report for the year 2013-14.

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

There is a steady increase in the number of research students in the Centre pursuing various academic programmes. The present student strength is around 300. Forty seven students joined the Centre during August 2013 admissions including three students who joined during mid-year admission in January 2014. Twenty six students were awarded Ph D degrees, seven with M S (Materials Science), four with M S (Eng.), nine with M S in Biological Sciences and two students were 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. According to CSIR-NISTADS report published in 2013*, based on citation data collected from Science Citation Index-Expanded and Scopus for the year 2010-11, it was found that JNCASR had the highest value (6.87) of Citation Per Paper (CPP) for the year 2010-11 amongst all the organisations in India.

It is a matter of immense pride for the whole scientific community in India and JNCASR in particular, that our Founder President Prof. C.N.R. Rao has been conferred upon *The Bharat Ratna*, the highest civilian award of Government of India. He received Honorary D.Sc. from the University of St. Andrews, U.K. Prof. Roddam Narasimha received *Life Time Excellence Award in the sphere of Earth System Sciences – 2013*, from The Earth System Science Organization, Ministry of Earth Sciences and *IETE Diamond Jubilee Medal* awarded by the Institution of Electronics and Telecommunication Engineers, New Delhi. 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 their endeavour in publishing books on science education and science policy, the book titled 'Science in India' containing accomplishments and recommendations of the Science Advisory Council to the Prime Minister during 2004-2013 and the challenges and opportunities in science and technology along with an approach to an action plan.

During the financial year, 26 patent applications (Indian Provisional Application-11, International Patent Application under PCT-8, USA-4, Japan-1, China-1 and South Korea-1) were filed and obtained 7 Patents {USA-5, Korea-1 and Europe-1 (received intimation regarding intension of granting patent)} for commercialisable inventions meeting the patentability criteria.

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. New facilities and programmes were launched and are used extensively by the researchers of the Centre. All these developments would not have been possible without the continuous support from the Department of Science and Technology.

K S Narayan
In-Charge President

* K.C.Garg and S. Kumar. Scientometric profile of Indian science as seen through Science Citation Index – Expanded 2010-2011. SRELS Journal of Information Management; Volume 50, Issue 5, October 2013. http://srels.org/index.php/sjim/article/view/43766

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 five 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 served his term as President since 2003 to 2013. Prof. K.S. Narayan is serving as In-charge President since 2013.

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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 25 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 Nanoscience Centre is equipped with the state of the art facilities for advanced research in materials science.

The Centre is equipped with good quality 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 seven students joined the Centre out of which 44 joined during August 2013 admission and three students joined during mid-year admission in January 2014. Twenty six students were awarded Ph D degrees, four with M S (Eng.), nine with M S in Biological Sciences, two with M S in Chemical Sciences and seven students were awarded M S in Materials Science. In addition, four students were awarded the Postgraduate Diploma in Science Education (PGDSE) and two students were awarded the Postgraduate Diploma in Materials Science (PGDMS). Currently about 278 scholars are pursuing their research career. The research and training at the Centre has led to the award of 176 Ph D degrees, 45 M S (Engg.), 3 M S (research), 65 M S (of Int Ph D), 1 M Sc (by research) degrees and 4 PGDSE and 2 PGDMS 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. C.N.R. Rao has been conferred upon The Bharat Ratna, the highest civilian award of Government of India. Prof. Rao has also been chosen as one of the 25 Greatest Global Living Legends by NDTV. He received Honorary D.Sc. from the University of St. Andrews, U.K. Prof. Roddam Narasimha received Life Time Excellence Award in the sphere of Earth System Sciences – 2013. The Earth System Science Organization, Ministry of Earth Sciences. Prof. Tapas Kumar Kundu has received Journal of Biochemistry (JB) Prize for 2013 instituted by The Japanese Biochemical Society. Prof. Umesh V. Waghmare was selected as Adjunct Professor at the Tata Institute of Fundamental Research (TIFR) and a recipient of 2nd Young Career Award in Nano Science & Tech-2014. Prof. Swapan K Pati has received TWAS (The World Academy of Science) Prize in Chemistry (shared) in September 2013. Prof. Shobhana Narasimhan was named one of "India's most Inspiring Women Engineers and Scientists" by Engineering Watch. Prof. Meheboob Alam received Outstanding Referee Award (2014) from American Physical Society's Physical Review and Physical Review Letters Journals. Prof. Tapas Kumar Maji received NASI-Scopus Young Scientist Awards for the year 2012 in Chemistry and MRSI (Materials Research Society of India) Medal for 2014. Dr. Subi J. George has been named as Emerging Investigator by Journal of Materials Chemistry (2014).

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 254 scientific papers in reputed international journals during the year 2013-14, 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 for 2014. Seven students of Project Oriented Chemistry Education (POCE) 2011-13, who had completed the programme successfully, are enrolled to M.Sc. degree programme in different institutions of the country. Two students of POCE batch of 2009-11 have joined Ph. D. programme in the U.S.A. and one student is pursuing higher studies at the Netherlands. Advertisement for the year 2014-17 Project Oriented Biology Education (POBE) was released and 345 applications were received. Six visiting fellows were selected for the Visiting Fellowships Programme 2013-14 under the Physical Sciences categories. Under JNCASR-CICS Fellowship, 28 candidates have been selected since 2010. Of these, 7 have been given certificates on successful completion of their training programme at institutions across the country. For the fellowship programme of 2013, 8 fellows were selected; of which 2 have completed.

Since the beginning of the financial year 2013-14, fifteen Discussion Meetings, seventeen international conferences, workshops, and symposia were supported, either wholly or partially by the Centre. Around eighty two seminars were held in addition to nine Endowment Lectures, two Silver Jubilee lectures and one Special Lecture delivered by eminent scientists.

HIGHLIGHTS OF RESEARCH AND OTHER ACTIVITIES

Research

Chemistry and Physics of Materials Unit (CPMU)

Strategies to develop efficient organic solar cells and field effect transistors have been implemented and studied. Research in Bioelectronics has been undertaken toward exploration of soft-electronic polymers for biophysical problems and their utilization in tissue engineering and for vision prosthetic elements. Mesoporous silica having flexible nonporous have been prepared by non-covalent, charge-transfer based interactions. The formation of internal electric field and its effect on ferroelectric polarization have been investigated in detail on a polycrystalline sample of multiferroic $TbMnO_3$. A complex spiral magnet, $BiMnFe_2O_6$ has been investigated for possible multiferroic properties. Progress has been made in understanding the reasons for the high efficiency of the newly developed PDI based solar cells. Tools for controlling the conformation of organocatalysts have been developed. A novel route has been developed to design non-proteinogenic α-amino acids. The transport of carbon dioxide in a decarboxylase enzyme has been studied using MD simulations. The adsorption of CO_2 in many metal organic framework solids has been modelled. Transparent conductors have been developed based on interconnected metal wire networks with optoelectronic properties better than oxide films. Using these networks, several optoelectronic devices have been fabricated. Nano scale optical and magnetic study of different spinel oxides was done. The Molecular Materials Laboratory has been involved in synthesizing Metal-Organic Frameworks (MOFs) at nanoscale by employing certain synthetic protocols. A hybrid of one flexible MOF and aminoclay have been synthesized, where strong electrostatic interaction between carboxylate groups of the MOF and amine group of the aminoclay driving formation of nanoparticles of MOFs on clay matrix. Strategies to develop efficient organic solar cells and field effect transistors have been implemented and studied. In the area of Bioelectronics, research has been undertaken towards exploration of soft-electronic polymers for biophysical problems and their utilization in tissue engineering and for vision prosthetic elements. The Light Scattering Laboratory has carried out high pressure Raman and X-ray experiments on Metal Organic Frameworks, and multiferroics to study the physics of these materials. High pressure X-ray beamline was setup in the Indian Beamline, KEK, Photon Factory, Tsukuba, Japan for the Department of Science and Technology. The growth of GaN nano wall network and structural, optical and electrical properties were studied. High mobility InN epilayers were grown by reducing the defect density by depositing it on a special GaN nanowall network template. InGaN alloy films and nanostructures are grown by MBE, where the band gap variation was done by varying in composition without phase separation.

Education Technology Unit (ETU)

The Education Technology Unit is involved in the concept, development and production of multimedia CD-ROMs 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 English and vernacular Indian languages. The highly popular Lectures/Workshops for students and teachers in the areas of Physics, Chemistry and Biology were organised. Book titled 'Science in India' was produced consisting of a brief presentation of the accomplishments and recommendations of the Science Advisory Council to the Prime Minister during 2004-2013 along with the challenges and opportunities in science and technology along with an approach to an action plan. The book was released in New Delhi by the Hon. Prime Minister on July 8, 2013. The Summer 2012 Science Outreach Programme was conducted in association with Himalayan Gram Vikas Samiti, Gangolihat by Prof. K.S. Valdiya on May 15-16, 2013. The POCE program for the year commenced in May 2013. Ten lecture programs for students and teachers were conducted during 2013. A program for INSPIRE students and a four-day Science Orientation Workshop for Jawahar Navodaya Vidyalaya students were also conducted. Teachers-students programs/workshops were conducted under the auspices of the Science Outreach Program on June 28, 2013. The Science Teachers Award Function cum lecture program was organized and the recipients for Outstanding Science Teachers were Shri. Navneet Gupta and Shri. M.V.S. Swamy. The Karnataka State Council for Science & Technology, IISc, Bangalore, Royal Society of Chemistry, London, The CNR Rao Hall of Science and ETU, JNCASR jointly organized and hosted the Knowledge Exchange Workshop–Chemistry on October 3-5, 2013. A 'Science Orientation Workshop' for Class XI students of Jawahar Navodaya Vidyalaya Students was organised. SOP-POCE has conducted Eleven Workshops on

'Experiments using College Chemistry Kit' between July 2013 – January 2014 for the science Pre-university students and teachers from different colleges of Karnataka in which 256 students and 16 teachers participated.

Engineering Mechanics Unit (EMU)

One of the major discoveries from Prof. Roddam Narasimha's group was the discovery of the dynamics of turbulent flows that has an interesting link with the statistical mechanics of a vortex gas, which is a Hamiltonian system of parallel line vortices in an inviscid fluid.

In Prof. K.R. Sreenivas's group, 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.

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 Dr. Ganesh Subramanian worked on the areas such as concentration fluctuations in bacterial suspensions; continuous spectrum of the elastic Rayleigh equation; effects of inertia on the motion of non-spherical particles; role of micro-scale inertia in multiphase heat-transfer.

Evolutionary & Organismal Biology Unit (EOBU)

*D*uring the year 2013-2014, the faculty of EOBU continued to conduct research in the broad areas of animal behavior, phylogeography, chronobiology, evolutionary genetics, neurogenetics, and population dynamics. Questions in the areas of (a) social organization in Asian elephants, (b) estimation of elephant population sizes through mark-recapture sampling, (c) biogeography of mammals in the Western Ghats, (d) communal roosting in common mynas, (e) comparative behavioural neurobiology, (f) neurogenetics of sleep, (g) fruit flies as a model system for neurodegenerative disorders, (h) circadian entrainment to temperature cycles, (i) study of circadian rhythms in nature, (j) evolution of adaptations to crowding, especially the interplay of food deprivation and waste buildup, (k) fruit fly metapopulation dynamics and stability, and (l) life history evolution are currently being addressed. The Unit also continues to train personnel in the area of whole organismal biology through the PhD, Integrated PhD and MS programmes, as well as through participation of the faculty in POBE and SRFP programmes of the JNCASR as well as similar outreach programmes run by the three Indian Science Academies and by DST and KVPY.

Geodynamics Unit (GDU)

Areas of research in this Unit were: active faults and geomorphic changes; dams in geodynamically active belts; tectonics and earthquake mechanisms along the Himalayan arc; geomorphology and climate evolution in the Himalayan region; Tsunami hazards and post-seismic processes and plate deformation along the Andaman-Nicobar subduction zone; intra-continental tectonics and earthquakes.

Molecular Biology and Genetics Unit (MBGU)

In Chromatin Biology Laboratory, the chromatin TP2 was 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.

The 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.

In Vascular Biology Laboratory, a comparative approach has been made by using embryonic stem cell models, mouse developmental biology and *Drosophila* genetics, to decipher the roles of novel genes expressed early in the cardiovascular and hematopoietic systems. Recently, two new sibling human embryonic stem cell (hES) lines from discarded embryos have been derived and differentiated to cardiovascular derivatives that can be cultured to purity. These are called BJNhem19 and BJNhem20 and have been deposited in the UK Stem Cell Bank.

Molecular Virology Laboratory has screened a large number of Indian clinical samples and identified an immunodominant B-cell epitope in the cysteine-rich domain of Tat only in the HIV infected people. This finding has a direct relevance for HIV vaccine design.

Transcription and Disease Laboratory has discovered human histone chaperone NPM1, which is able to relieve the centromeric histone H3 variant, CENP-A mediated repression of transcription from the chromatin template. It was also shown that NPM1 gets phosphorylated by Aurora kinases with functional consequences on the process of cytokinesis. The laboratory has successfully generated two monoclonal antibodies against histone chaperone NPM1 and acetylated-NPM1. Both have been successfully commercialized by U.S. based company, Merck-Millipore. The research group has also found out, from the samples collected from across the globe, that the positive coactivator, PC4 is predominantly down-regulated in breast cancer. The mechanisms behind this have been partially elucidated.

The researchers in Molecular Mycology Laboratory have studied centromeres of a pathogenic yeast, *Candida dubliniensis* and compared centromere sequences with those of a closely- related yeast *Candida albicans*. The studies indicate that centromeres are evolving at a rate faster than any other genomic region in these two species.

New Chemistry Unit (NCU)

Several aspects of the chemistry of materials are being pursued by Prof. C. N. R. Rao. For more than five decades, Prof. Rao has been working on transition metal oxides. He continues to work on some recent aspects of metal oxides. Artificial photosynthesis based on inorganic nanomaterials a recent area of research Prof. Rao is involved in. These studies include oxidation as well as reduction of water.

Dr. T. Govindaraju's research group has established protocols to develop biomimetic molecular self-assembly-based systems and materials through chiral transcription, amplication and retentive helical memory for use in chiral technology and to understand spontaneous deracemization and amplication pathways for biological homochirality. The group is also working in the area of neurodegenerative diseases (Alzheimer's, type 2 diabetes and Parkinson's, diseases) and nucleic acid chemistry (templated nucleic acid ensembles for drug targeting and delivery, biosensing and global nucleic acid structure and functional analysis).

Dr. Jayanta Haldar's research group has worked on multi-drug resistant Gram-positive bacteria like vancomycin resistant *Enterococci* (VRE) and *Staphylococci* (VISA and VRSA); as well as pan-drug resistant New Delhi metallo-β-lactamase-1 (NDM-1) producing Gram-negative bacteria which have become a threat to the global public health. Recently, novel vancomycin analogues have been developed which could not only overcome acquired resistance against VRE, VISA and VRSA but also took care of the inherent vancomycin resistance towards Gram-negative bacteria.

Dr. Kanishka Biswas's research group has discovered a new class of materials, cubic I-V-VI_2 (where I = Cu, Ag

alkali metal; V = Sb, Bi; and VI = S, Se, Te) semiconductors, which can posses very low thermal conductivity thus can give rise to high thermoelectric performance. In the last year, promising thermoelectric materials have been developed based on Pb-free $SnTe_{1-x}Se_x$ system, which has immense importance in industry.

Dr. Ranjani Viswanatha has used theoretical methods to predict varied results for the determination of the absolute energy levels of conduction and valence bands as a function of size and till date this has been poorly understood experimentally due to the lack of a simple technique. Using this novel technique, she has not only explored the conduction band and valence band variation as a function of size but has also opened up new ways to understand the role of ligands in passivating the surface as well as temperature dependence of band edge variation adding significantly to the understanding of electronic and optical properties of such systems.

Dr. Sebastian C. Peter has discovered several new intermetallics, which are interesting in terms of the structural diversity and physical properties. The low dimensional intermetallic materials have been successfully used as good catalysts in selected chemical reactions.

Dr. Subi J. George's research group has undertaken research towards the design of solution processable, luminescent organic-inorganic hybrids by the co-assembly ionic dyes and nanoclay particles. In addition, dipolar dyes have been synthesized for the design of self-assembled nanostructures with NLO and optical wave guiding functionalities. Research on supramolecular charge-transfer assemblies has been extended to impart them with novel properties like ferro-electricity. In addition, a variety of chiral assemblies have been synthesized, exhibiting amplified circularly polarized luminescence.

Dr. Ujjal Gautam's research group has worked toward the development of a model system which is based on fullerene, C60, that is believed to provide key insight to the formation of nanostructures (self-assemblies in particular) in a solution. Based on the understanding of self-assembly, key organic molecules have been easily separated from one another, which is extremely difficult otherwise.

Prof. H. Ila's research group has 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.

Prof. Swapan Kumar Pati's research group has investigated the possibility of 2D boron sheets (BS) as anode material in lithium ion battery (LIB). Among α, $\alpha 1$, and η 4/28 metallic BSs, planarity is retained for $\eta 1$ and η 4/28 polymorphs after bilayer formation. In the search of efficient adsorbent for HF gas without its chemical decomposition, experimentally synthesized point defect containing nitrogen-rich single vacant (SV) 2D sheets are studied using ab initio molecular dynamic simulations.

Prof. A. Sundaresan's research group has done an in-depth investigation on the formation of internal electric field and its effect on ferroelectric polarization on a polycrystalline sample of multiferroic $TbMnO_3$. A complex spiral magnet, $BiMnFe_2O_6$ has been investigated for possible multiferroic properties. An ordered perovskite which was predicted to be multiferroic has been shown to non-ferroelectric.

Prof. M. Eswaramoorthy has shown that mesoporous silica having flexible nanopores have been prepared by non-covalent, Charge-Transfer based interactions. Using the same approach the surfaces of the nanopores have been made to show charge reversal and hence gating the ion-transport through the nanopores.

Dr. Sridhar Rajaram's research group has made progress in understanding the reasons for the high efficiency of newly developed PDI based solar cells. Tools have been developed for controlling the conformation of organocatlaysts. Also, a novel route has been developed to design non-proteinogenic α -amino acids.

Dr. Tapas Kumar Maji's research group has synthesized a multi-chromophoric hybrid system where exciplex emission is sensitized by energy transfer which is unprecedented. Recently, it was 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.

Theoretical Sciences Unit (TSU)

Prof. Umesh V Waghmare's research group has predicated the thinnest known ferro electric material using first-principles calculation. Based on its semiconducting properties, development of dipolectronic devices has been proposed. The multiferroic behavior of elemental Se has been explained. Using MD simulations, epilaxial strain temperature phase diagram of $PbTiO_3$ has been determined.

Some significant research findings of Prof. Shobhana Narasimhan's research group were: 1) A simple model was developed that can explain how the magnetoresistance changes with contact geometry in a molecular spintronics set-up; 2) A theory was developed to explain the role of s and p electrons in gold nanocatalysis; 3) Routes for functionalizing graphene and other carbon nanostructures so as to increase gas uptake were suggested; 4) Insight was obtained into the various contributions from different kinds of van der Waals interactions to physisorption on graphene; 5) It was shown that co-adsorption of gases can move patterns on surfaces into regions of the phase diagram that are more accessible to experiments.

In Dr. N. S. Vidhyadhiraja's research group, investigations of disorder and proximity effects in s-wave superconductors have been carried out. A new theoretical method for investigating strongly correlated electronic systems that incorporates multi-orbital effects, and Hund's coupling and also integrates density functional theory based first principles methods has been under development.

Research Group of Dr. Subir Das has taken up problems related to equilibrium and nonequilibrium statistical mechanics. In this broad area, significant new understanding has been obtained on specific issues such as dynamic critical phenomena in fluid phase transition; hydrodynamic effects in kinetics of phase separation in bulk as well as confined systems; aging properties in kinetics involving solid-sold, liquid-liquid, vapor-liquid and paramagnetic to ferromagnetic transitions; phase behavior of systems containing active particles; effects of disorder in chemical reaction diffusion systems; nucleation and growth of droplets in phase transitions; pattern formation in Granular matter.

Prof. Kavita Jain's research group has elucidated the connection between adaptive walk properties and the distribution of fitness effects. The stationary state properties of a population evolving under the joint action of selection, drift and recombination has been calculated.

Prof. Swapan K Pati's research group has found that the alignment of magnetic ions within the DNA helix that created a spin channel due to the efficient orbital interactions between the magnetic ions. For human telomeric G-quadruplex, it was found that the unfolding of the qudruplex occurs via triplex intermediate.

International Centre for Materials Science (ICMS)

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

Prof. S.M. Shivaprasad at Epitaxy laboratory is involved in forming thin films and nanostructures of III-nitride semiconductors with novel functionality and properties. GaN, ALN and InN thin films, and their alloys were kinetically grown, on Sapphire and Silicon substrates to filter dislocations, defects and strain in a Molecular Beam Epitaxy system to obtain self-assembled, epitaxial, catalyst-free nanostructures to tailor their properties. Surface modifications was employed such as superstructure and intermediate layer formation to optimize conditions for high optical, structural and electrical performance that are evaluated by several sophisticated complementary in-situ and ex-situ characterization techniques such as RHEED, XPS, HRXRD, HRTEM, FESEM, PL, CL, STM/AFM/MFM, Hall, SQUID, PPMS, etc.

Dr. Ranjan Datta has worked on the areas such as magnetic characterization at the nano scale; quantitative imaging; optical nanoscopy; p-doping in ZnO.

In the Soft Matter Lab of Dr. Rajesh Ganapathy, research was mainly focused on the themes such as understanding yielding mechanisms in soft amorphous solids; glass transitions driven by random pinning; and elucidating the mechanism that govern shear-thickening in suspensions of anisotropic colloidal particles.

Dr. Sridhar Rajaram's research group has developed twisted perylenes as alternatives to fullerenes. The photophysical properties have been studied using Transient Absorption Spectroscopy and also studied the aggregation behavior of these molecules by embedding them in ferroelectric polymers. Apart from this, the effect of conformational constraints in organocatalysts was explored and a novel method for the synthesis of amino acids was developed.

Dr. Ranjani Viswanatha has used theoretical methods to predict varied results for the determination of the absolute energy levels of conduction and valence bands as a function of size and till date this has been poorly understood experimentally due to the lack of a simple technique. Using this novel technique, she has not only explored the conduction band and valence band variation as a function of size but has also opened up new ways to understand the role of ligands in passivating the surface as well as temperature dependence of band edge variation adding significantly to the understanding of electronic and optical properties of such systems.

Inauguration of the Sheikh Saqr Laboratory: The Sheikh Saqr Laboratory located in the new CCMS building was inaugurated on August 26, 2013 by His Highness Sheikh Saud Bin Saqr Al Qasimi.

Thematic Unit of Excellence in Computational Materials Science (TUE-CMS)

A Monte Carlo simulation program (software) has been indigenously developed which can be used to study phase equilibria of molecular substances, primarily liquids and gases. The self-assembly of chromophoric molecules in organic solvents is of vital interest in light harvesting applications. The energetics of supramolecular oligomerization of such molecules in gas phase and in organic solvents using quantum and classical approaches have been studied. The importance of dipole-dipole interactions in such systems has been shown through undertaken research. Work on transition metal DNA complexes and their interesting electronic and magnetic properties has been undertaken. Detailed theoretical analysis of 1-dimensional transition metal di-chalcogenides was carried out with focus on electronic and vibrational properties. Ferroelectricity in the 1T polymorph of MoS_2 was also demonstrated, making it the world's thinnest known ferroelectric semiconductor. Based on this, a new class of "dipolectronic" devices have been proposed. Point defects in twisted bilayer graphene have been studied using DFT. The weak adsorption of hydrogen on carbon nanostructures too have been studied. Magnetoresistance of a system of dithienylethene molecule between spin polarized nickel has been studied for spin transport applications. The co-adsorption of Br_2 and H_2 on Si(001) have also been investigated using DFT calculations.

Thematic Unit of Excellence on Nanochemistry (TUE-Nano)

New synthetic strategies for nanomaterials and investigating properties leading to applications are the two important aspects, currently pursued in the Unit. The synthesized nanomaterials include size and shape controlled metal and semiconductor nanocrystals, functionalized carbon nanotubes, graphene and its derivatives as well as analogues, metal and semiconductor nanowires, nanocomposites, semiconductor wall-like structures, organic as well as biomaterials. Various wet chemical routes are being employed for the synthesis of pristine and doped semiconductor Nanocrystals. Other unique materials being investigated are graphene and functionalised graphene. Surface physics at sub-monolayer coverage and molecular beam epitaxy of thicker films have been combined to produce epitaxial 2D films and nanostructures of III-nitrides. Patterning of metals using predesigned templates has led to large area wire networks. These networks have been used on transparent substrates to effectively replace ITO in optoelectronic devices. The bionano-activities are extended to identifying and developing new functional nanomaterials for intracellular drug delivery. Developing intracellular carriers that have no barriers across the cell membranes and nuclear membranes could find potential therapeutic applications.

Academic Activities

During the year, forty seven students joined the Centre out of which 44 joined during August 2013 admission and three students joined during mid-year admission in January 2014. The present student strength is 278. Twenty six students were awarded Ph D degrees, four with M S (Eng.), nine with M S in Biological Sciences, two with M S in Chemical Sciences and seven students were awarded MS in Materials Science. In addition, four students were awarded the Postgraduate Diploma in Science Education (PGDSE) and two students were awarded the Postgraduate Diploma in Materials Science (PGDMS).

Fellowships & Extension Programmes

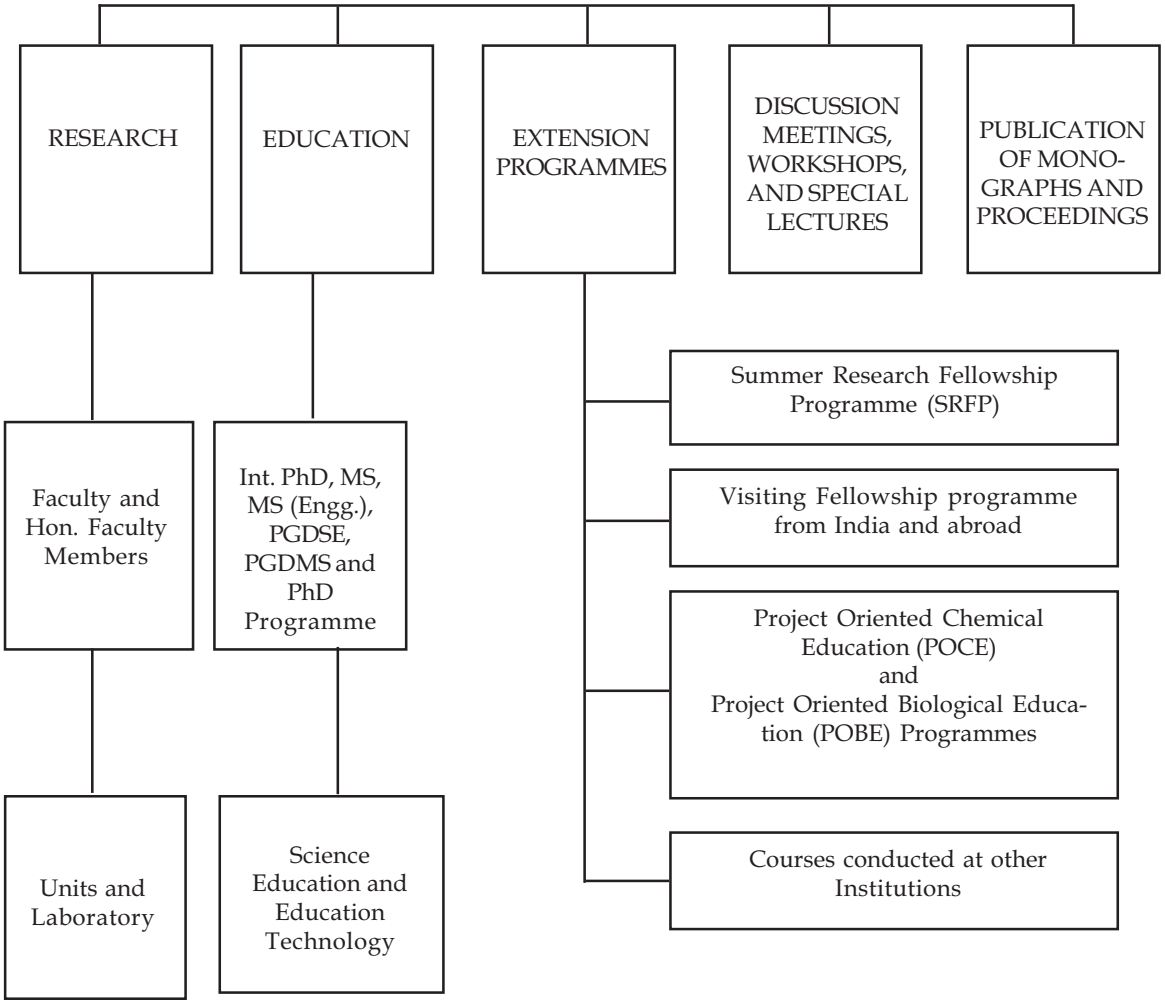
For the Summer Research Fellowships programme, 73 students were selected and offered the fellowships for 2014. Seven students of Project Oriented Chemistry Education (POCE) 2011-13, who had completed the programme successfully, are enrolled to M.Sc. degree programme in different institutions of the country. Two students of POCE batch of 2009-11 have joined Ph. D. programme in the U.S.A. and one student is pursuing higher studies at the Netherlands. Advertisement for the year 2014-17 Project Oriented Biology Education (POBE) was released and 345 applications were received. Six visiting fellows were selected for the Visiting Fellowships Programme 2013-14 under the Physical Sciences categories. Under JNCASR-CICS Fellowship, 28 candidates have been selected since 2010. Of these, 7 have been given certificates on successful completion of their training programme at institutions across the country. For the fellowship programme of 2013, 8 fellows were selected; of which 2 have completed.

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

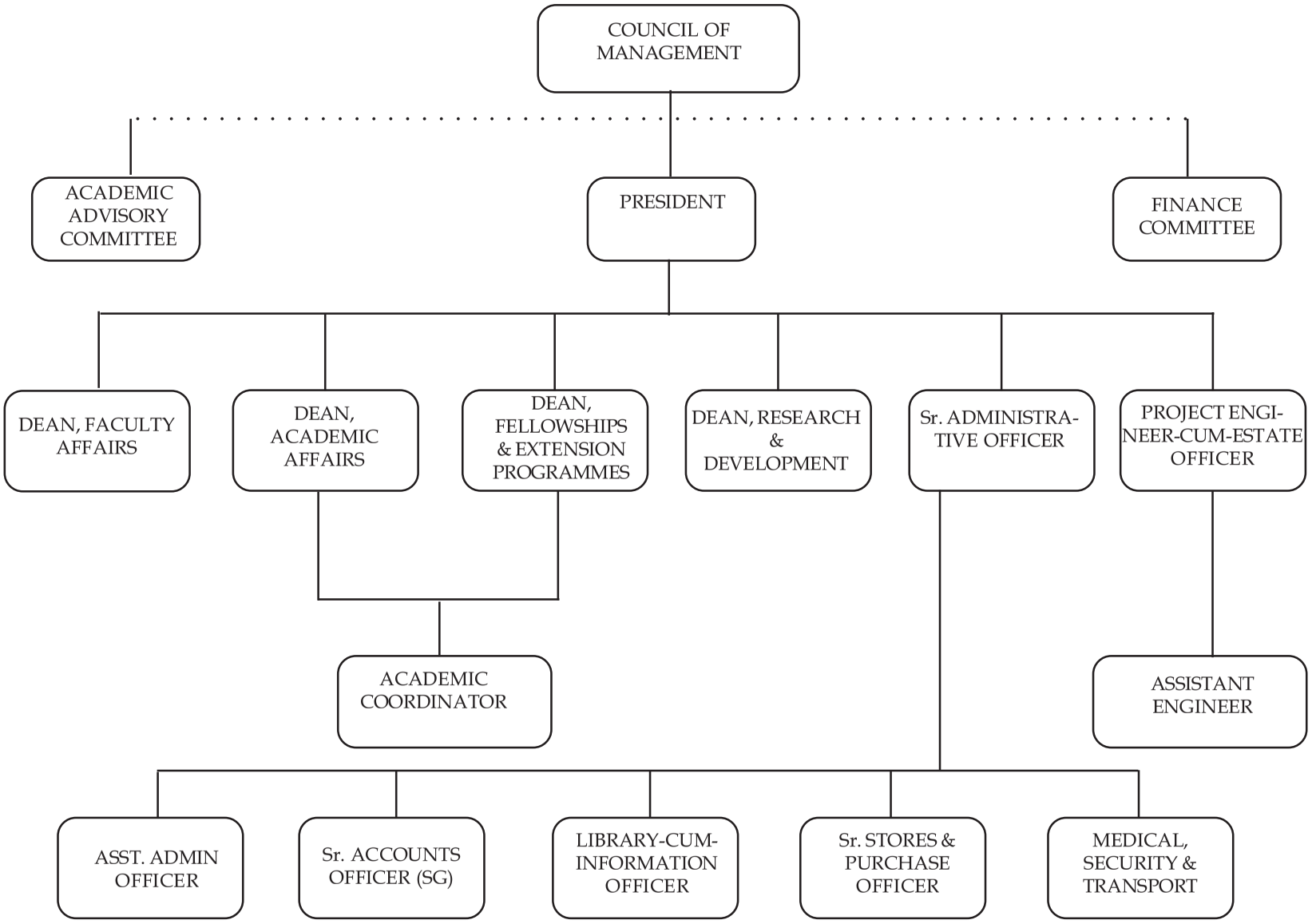
The Centre follows the national policy on reservation and official language as per rules and orders issued by the Government of India with necessary guidelines from the Council of Management from time to time. During the current year there were no cases pertaining to the Centre appeared before the CAT.

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
President, JNCASR	Member
Prof. C.N.R. Rao Hon. President, JNCASR (JNC nominee)	Member
Prof. K. VijayRaghvan 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:

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

President, JNCASR	Chairman (Ex-officio)
Prof. G.U. Kulkarni (2013-16) Dean, Faculty Affairs, JNCASR	Member (Ex-officio)
Prof. Shobhana Narasimhan (2013-16) Dean, Academic Affairs, JNCASR	Member (Ex-officio)
Prof. Namita Surolia (2012-14) 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 (2012-14) 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 (2012-14) SSCU, IISc	Member
Prof. Devang V Khakhar (2012-14) 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 2013 which included lectures by the faculty on the advances made in various research areas. Local faculty meetings were held in August 2013 and February 2014 to review the progress and provide inputs wherever required.

Administration

President

Dean, Faculty Affairs	
G. U. Kulkarni	Ph D (IISc)
Dean, Academic Affairs	
Shobhana Narasimhan	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	
Subi Jacob George	Ph D
Associate Warden	
Sheeba Vasu	Ph D
Sr. Administrative Officer	
A N Jayachandra	B Com (Mysore), ICWA (Inter)
Assistant Administrative Officer	
C S Chitra	B Com (Bangalore)
Academic Coordinator	
Princy Jaison Pereira	Ph D (Gujarat)
Sr. Accounts Officer (SG)	
R S Gururaj	B.Sc. (Mysore) M P Ed (Bangalore)
Jr. Accounts Officer	
Venkatesulu B	B.Sc. (Gulbarga)
Sr. Stores & Purchase Officer	
K Bhaskara Rao	M.Sc. (Hyderbad), M Phil (New Delhi)
Library-cum-Information Officer	
Nabonita Guha	MLIS (Varanasi)
Sr. Secretary to President	
A Srinivasan	B A (Hyderabad)
Project Engineer	
S Chikkappa	B E (Mysore)
Project Engineer Gr.II (Civil)	
Nadiger Nagaraj	DCE
Junior Engineer (Civil)	
Veeresha N.R.	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)
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

Mesoporous silica having flexible nonporous have been prepared by non-covalent, charge-transfer based interactions. Using the same approach the surfaces of the nanopores have been made to show charge reversal and hence gating the ion-transport through the nanopores.

The formation of internal electric field and its effect on ferroelectric polarization have been investigated in detail on a polycrystalline sample of multiferroic $TbMnO_3$. A complex spiral magnet, $BiMnFe_2O_6$ has been investigated for possible multiferroic properties. An ordered perovskite which was predicted to be multiferroic has been shown to non ferroelectric.

In the last year, progress has been made in understanding the reasons for the high efficiency of the newly developed PDI based solar cells. Tools for controlling the conformation of organocatalysts have been developed. A novel route has been developed to design non-proteinogenic α-amino acids.

The transport of carbon dioxide in a decarboxylase enzyme has been studied using MD simulations. The adsorption of CO_2 in many metal organic framework solids has been modelled. The interface of room temperature ionic liquids with solid substrates has also been studied using MD simulations.

Transparent conductors have been developed based on interconnected metal wire networks with optoelectronic properties better than oxide films. Using these networks, several optoelectronic devices have been fabricated. Gold microcrystals in the form of pentagonal bipyramidal rice-like morphology have been synthesized and their plasmonic properties have been studied.

Nano scale optical and magnetic study of different spinel oxides. Optical and magnetic study of ZnO, CoO by HREELS. Nano scale structural variations in Pb free piezo electric material.

The Molecular Materials Laboratory has been involved in synthesizing Metal-Organic Frameworks (MOFs) at nanoscale by employing certain synthetic protocols. The higher surface areas (higher S/V ratio) of the nanoparticles enables the incorporation of versatile properties into nanoscale in a better way. Thus, nanoscale MOFs (NMOFs) having different morphologies would be interesting for catalytic activities, separation processes, enhanced solution processability, ion exchange, sensing and sorption properties over the respective bulk MOF. Successfully fabrication of few NMOFs of spherical morphology has been done by coordination modulation method. These NMOFs have shown significant higher gas storage capacity compared to bulk crystals attributed to the smaller diffusion barrier at nanoscale. The fact has been also validated through extensive kinetics measurements. New MOF i.e., Composite Materials (MOF-silica hybrids, MOF-clay hybrids) have been developed to achieve better materials properties. A hybrid of one flexible MOF and aminoclay have been synthesized, where strong electrostatic interaction between carboxylate groups of the MOF and amine group of the aminoclay driving formation of nanoparticles of MOFs on clay matrix. Tunable gate-opening pressure and adsorption uptake has been successfully achieved by making a series of such composites by varying the content of aminoclay.

Strategies to develop efficient organic solar cells and field effect transistors have been implemented and studied. Research in Bioelectronics has been undertaken toward exploration of soft-electronic polymers for biophysical problems and their utilization in tissue engineering and for vision prosthetic elements.

The Light Scattering Laboratory has carried out high pressure Raman and X-ray experiments on Metal Organic Frameworks, multiferroics to study the physics of these materials. Novel nanostructures for Surface Enhanced Raman Spectroscopic studies have been prepared. High pressure X-ray beamline was setup in the Indian Beamline, KEK, Photon Factory, Tsukuba, Japan for the Department of Science and Technology. Most of the work has been either published or communicated to the International journals.

The growth of GaN nano wall network and structural, optical and electrical properties are studied. High mobility InN epilayers are grown by reducing the defect density by depositing it on a special GaN nanowall network template. InGaN alloy films and nanostructures are grown by MBE, where the band gap variation was done by varying in composition without phase separation.

New programmes launched during the year

- Fabrication of thin films of potential multiferroic materials using RF magnetron sputtering.
- Modelling of the self-assembly of organic chromophores in solution has been initiated. Coarse grained and atomistic MD simulations are being carried out.
- p-doping problem in ZnO.
- Culture Laboratory is being established.
- High pressure x-ray studies of materials on various synchrotron sources like Elettra, Italy and Photon Factory, Italy was started.
- Study of chemical etching on the properties of III-nitride films and nanostructures.
- Nano-ELOG approach for growth of defect-free III-nitride films.

The following are the members of the Unit:

Chair

S Balasubramanian	Ph D

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
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, 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., Dibyashree Chakraborti, Syamantak Roy, V. Rajaji, Rishav Harsh, Priyank Singh, Abhiroop Lahiri, Nikita Gupta

Research Scientist D

Anant D Kulkarni

Research Scientist B

Ananda Raman, Vijay Amirtharaj A

Research Associates

Anurag Prakash Sunda, B E Prasad, Diptikanta Swain, K. N. Harish, Kathiresan Natarajan, Kishore V Chellappan, Krishnendu Biswas, N Padmavathy, Narendra Kurra, Partha Pratim Kundu, Rambabu Angalakurthi, Ritu Gupta, Saikiran Vadavalli, Sandeep Kumar Reddy, Sandipan Roy, Sorb Y A

Research Associates (Provisional)

D H K Murthy, Kuraganti Vasu, Shaji Varghese, Venkata Ravi Kumar Darbha, Poonam Sharma

Research Fellow

A Gomathi

DST Post-Doctoral Fellow

Ganga Periyasamy

Fellow

Jay Ghatak

Programme Coordinator

Vanitha B

Programme Assistant

K Venkatesh

Technical Assistants

N R Selvi, Kishor Upadhyaya

R&D Assistants

Bolla Govinda Rao, Dhruv Joshi, Govindan Kutty R, Kartikeya Srivastava, Prahlada B L, Salikolimi Krishnachary, Sandheep P R, Srikanth Revoju, Thripuranthanka M, Warankar Avinash Manohar, Mahesh J I, Bhavya D R, Swati Chakraborty, Syamantak Roy

Project Assistant (Level-II)

T Basavaraj

Lab Helper

Victor Satish

Glass blower

P K Parthiban

Trainee

Sharvani Shivaprasad

Accounts / Assistant Trainee

Kohera Tasneem

Education Technology Unit

Activities and Achievements

The Education Technology Unit is involved in the concept, development and production of multimedia CD-ROMs 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 English and vernacular Indian languages.

The C.N.R. Rao Hall of Science and Education Technology Unit has conducted the highly popular Lectures/ Workshops for students and teachers in the areas of Physics, Chemistry and Biology.

Three students of the PGDSE have taken up a course on multimedia in the month of April 2013. The students submitted multimedia presentations on their chosen subject (Physics, Chemistry and Biology) and were introduced to the basics in Multimedia.

The task of producing the Print-ready copy of the book titled 'Science in India' was completed. The books consists of three parts starting with a Vision document followed by a brief presentation of the accomplishments and recommendations of the Science Advisory Council to the Prime Minister during 2004-2013. Part 3 deals with the challenges and opportunities in science and technology along with an approach to an action plan. The layout was designed in accordance with Prof. C.N.R. Rao's vision for the document. The formatting, graphics, cover design were completed with visuals from JNCASR. The book was released in New Delhi by the Hon. Prime Minister on July 8, 2013. Around 2,150 copies were printed and distributed to the Indian Academy of Sciences and the Department of Science & Technology, New Delhi. A soft copy of the same was sent to SAC-PM office for uploading it on the websites of DST and the PMO.

The cover designs for the book titled 'Readings in Solid-state and Materials Chemistry (A selection of research papers of CNR Rao)' were designed and print-ready copies were sent to M/s World Scientific who choose one of them to use as the cover design of the book.

The CNR Rao Hall of Science Webpage is maintained and updated with the events and activities of the lecture programs conducted for students and teachers. The lectures from the lecture programs were uploaded and can be accessed through the feature 'Lecture Videos' in the webpage.

The book 'Professor C.N.R. Rao: a short biography' was updated with the latest information and new photographs in suitable format were used for redesigning and reformatting the book. 1,000 copies of the book were distributed to participants of `Directions in Materials Science (DMS)' Conference. The book 'Publications of Prof. CNR Rao' was designed, formatted and print-ready copy was completed. 200 copies were distributed at the DMS conference.

The coverpage of book titled 'Chemistry of Nanomaterials: selected papers of C.N.R. Rao' was designed and made print-ready for World Scientific. The book will be published shortly.

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 15-16, 2013. The CNR Rao Hall of Science and ETU presented a 30-minutes multimedia presentation in Hindi. Excerpts from the CD-ROM title "NanoWorld" were translated into Hindi and the text was made into bitmap images for incorporation into the presentation and the voice-over in Hindi completed at ETU was edited and included into the presentation. The presentation titled `Nanojagat' in Hindi was prepared for presenting at the CNR Rao Hall of Science sponsored Lecture program at Uttarakhand. Mrs. Indumati Rao presented the multimedia presentation. A powerpoint presentation `Nano ki duniya' was prepared by translating the presentation titled 'Nanoworld' into Hindi and putting these translations alongside the English subtitles for the Lecture by Prof. C.N.R. Rao in the Science Outreach Programme organized by the Himalayan Gram Vikas Samiti, Gangolihat on May 15-16, 2013.

The POCE program for the year commenced in May 2013. On June 4-5, 2013, a one-hour multimedia presentation was given from CD-ROMs 'Nanoworld' and 'Understanding Chemistry' to the students.

Ten lecture programs for students and teachers were conducted during 2013. In addition to the planned programs, a program for INSPIRE students and a four-day Science Orientation Workshop for Jawahar Navodaya Vidyalaya students were conducted at the MMM Amphitheatre, CNR Rao Hall of Science.

The CNR Rao Hall of Science and ETU commenced the Teachers-students programs/workshops conducted under the auspices of the Science Outreach Program for this year on June 28, 2013. The Science Teachers Award Function cum lecture program was organized and conducted at the Madan Mohan Malaviya Amphitheatre. The recipients of the CNR Rao Education Foundation sponsored 2012 prizes for Outstanding Science Teachers were Shri. Navneet Gupta and Shri. M.V.S. Swamy. The Lecture Program had one lecture in Chemistry and one in Geology. The titles of the lectures are: Chemistry: From matter to life, by Prof. K.N. Ganesh (IISER-Pune) and Himalayan Heights, by Prof. Rajeev Upadhyay (Kumaun University, Nainital). Around 225 students and teachers attended the program.

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

28 June 2013 – Lecture Program (Science Teacher Award Function)
22 July 2013– Program in Physics for students
27 August 2013 – Program in Biology for students
4 September 2013 – Program in Chemistry
19 September 2013 – Program in Chemistry for students
3-5 October 2013 – Knowledge Exchange Workshop - Chemistry
22-25 October 2013 – Science Orientation Workshop for Jawahar Navodaya Vidyalaya Students
6 November 2013 – Program in Chemistry (Jointly organized with NCU)
4 December 2013 – Program in Chemistry
12 December 2013 – Program in Biology for students
27 December 2013 – Inspire Program

In each of the above programs under the auspices of the Science outreach program, were participated by over 200 students and teachers. Programs consisted of lectures and demonstrations followed by an interactive Question and Answer session.

New Chemistry Unit faculty and students visited the CNR Rao Hall of Science on August 8, 2013. 40 faculty members and students visited the Chemistry of Materials Exposition and Prof. CNR Rao Archives and the film 'The Man who lives in the Future- Prof. CNR Rao' produced by Films Division was screened for them at the Madan Mohan Malaviya Amphitheatre.

A 'Program in Chemistry' was organized by the CNR Rao Hall of Science and ETU jointly with New Chemistry Unit for Class X students only on September 4, 2013. Prof. CNR Rao gave the lecture titled 'Celebration of Chemistry'. This was followed by an open discussion on the theme 'Chemistry in daily life' where NCU faculty and students participated in the interactive session. A chemistry quiz was conducted and this was actively participated by the students. This was followed by demonstrations of innovative experiments by NCU students, a treasure hunt and a visit to the Chemistry of Materials Exposition and Prof. CNR Rao Archives. The CNR Rao Hall of Science and ETU presented first, second prizes to the winners of the Chemistry Quiz and a Prize for the Best Question.

The Karnataka State Council for Science & Technology, IISc, Bangalore, Royal Society of Chemistry, London, The CNR Rao Hall of Science and ETU, JNCASR jointly organized and hosted the Knowledge Exchange Workshop–Chemistry on October 3-5, 2013. Prof. M.R.S. Rao inaugurated the workshop. Chemistry Teachers from various high schools from Bangalore and North Karnataka participated in the three-days workshop. The objective of the workshop was to develop the learning skills and expertise of chemistry teachers. The workshop had lectures, demonstration of a variety of teaching techniques, hands-on sessions and discussions along with laboratory work at the SOP-POCE laboratory.

The CNR Rao Hall of Science & ETU organized and conducted a 'Science Orientation Workshop' for Class XI students of Jawahar Navodaya Vidyalaya Students. These students and teachers were from different JNV's of Karnataka. 72 Students and 8 teachers participated in the four-days workshop conducted on October 22-25, 2013. Lectures in Physics, Chemistry and Biology on topics suggested by the teachers were conducted by

JNCASR Faculty members along with demonstration of experiments. A `Science Quiz' Program was conducted by students of Theoretical Sciences Unit. The first and Second teams were awarded prizes by the CNR Rao Hall of Science and ETU. All the participants were given the Book `Elements and the Periodic table' developed and produced by ETU. A visit to the Chemistry of Materials Exposition and Prof. C.N.R. Rao Archives was arranged for the participants. The Film `The Man who lives in the Future- Prof. CNR Rao' produced by Films Division was screened.

The CNR Rao Hall of Science & ETU jointly organized with New Chemistry Unit a `Program in Chemistry' on 6th November 2013. Prof. Uday Maitra gave the lecture /demonstration titled 'Chemistry is Fun' followed by a Open discussion. A 'Chemistry Quiz' was conducted with teams from different schools/colleges participating. The winning teams were given prizes. Dr. Ranjani Viswanatha and Dr. Sebastian C. Peter gave a lecture & video demonstration on `Virtual Material Chemistry Lab'. The Program concluded with a visit to the Chemistry of Materials Exposition and Prof. CNR Rao Archives. 175 students and teachers participated in the program.

The CNR Rao Hall of Science and ETU organized and conducted the `Program in Chemistry' on 4th December 2013. The lectures were delivered by Prof. CNR Rao, Prof. Michael L. Klein and Prof. Bettina V. Lotsch. The program had an interactive Q & A Session with some of the speakers. 215 students and teachers attended the program.

On the request of the organizers of the Inspire Science Nurture Camp, the `INSPIRE Program' was organised on 27 December 2013 for the students participating in this camp. Three lectures, one each in Physics, Chemistry and Biology followed by a Q & A Session were conducted at the Madan Mohan Malaviya Amphitheatre. The program ended with a visit to the Chemistry of Materials Exposition and Prof. CNR Rao Archives.

SOP-POCE has conducted Eleven Workshops on `Experiments using College Chemistry Kit' between July 2013 – January 2014 for the science Pre-university students and teachers from different colleges of Karnataka. 256 students and 16 teachers participated in these workshops.

A Program for students of Classes XI and XII was organized by IIT/Indore on 31st January 2014 at the Daly College Auditorium, Indore as part of the `Frontier Lecture Series in Chemistry'. Prof. CNR Rao gave the lecture titled 'Chemistry: Glorious Past and Exciting Future' and Mrs. Indumati Rao presented excerpts from the CD-ROM 'Nanoworld'. Around 1200 students and teachers attended the program. On February 15, 2014 Prof. Rao gave the lecture 'Intuition & Inspiration – Story of Science' to students and teachers at the Basaveshwar Science College, Bagalkot followed by presentation from Mrs. Indumati Rao.

A lecture program was organised on 11 March, 2014 for students and faculty of Sri Kongadiyappa College, Doddaballapura. There were two lectures by Dr. T. Govindaraju and Prof. S.M. Shivaprasad followed by a visit to the Chemistry of Materials Exposition and Prof. CNR Rao Archives. 120 students and faculty participated in the program.

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

In the field of Aerospace and Atmospheric Fluid Mechanics *Prof. Roddam Narasimha's group* has made following discoveries:
The dynamics of turbulent flows has an interesting link with the statistical mechanics of a vortex gas, which is a Hamiltonian system of parallel line vortices in an inviscid fluid. From the most extensive numerical simulations to-date of a temporal free-shear layer, it is found that (i) the bulk parameters of the vortex-gas solutions (mixing excluded) are close to experimental observations in plane mixing layers, and (ii) classical fluid dynamics represents an 'explosive' phase of an otherwise slow relaxation to equilibrium in the vortex gas, exhibiting in this phase a universality in the growth rate of the shear layer independently of widely-varying initial conditions. [1] An alternative approach to a free shear layer is via the evolution of a plane continuous vortex sheet, which is known to encounter a finite-time singularity during evolution. Taking the solution past the singularity invoking a viscosity 'switch' shows that such singularities keep appearing and disappearing over time in different parts of the flow region. [2] Considerable progress has also been recently made in DNS studies of the complex flow past a gas turbine blade, involving transition, relaminarization, separation bubbles and retransition, and of cumulus cloud flows.

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.

Jamming in Granular Matter: A new algorithm to identify the ideal jamming point under controlled stress has been provided (Phys. Rev. E 2014, April, Smith etal.) that performs better than the currently available algorithms

to simulate jamming in amorphous materials made of polyhedral particles. In a stress-controlled framework at equilibrium, the enthalpy is minimized and when the stress is hydrostatic this framework yields an isobaric, isoenthalpic ensemble. Such a stress constraint at zero temperature replicates the NPH-ensemble (commonly employed in molecular dynamics simulations of atomistic systems). In addition to probing the jammed configurations of Platonic (tetrahedra, octahedra, cube, etc) and Archimidean (truncated octahedra, etc.) solids, the versatility of the present algorithm to simulate jamming both hydrostatic and shear loadings has been demonstrated.

Theory for Flowing Granular Matter: Very recently it has been found that the directions of the translational and angular velocity of a sphere in driven granular gas can be strongly correlated -- this is dubbed orientational/directional correlation (Gayen an Alam, Phys. Rev. Lett. 2008). Such correlations do not exist in a molecular gas. A theory to account for higher-order corrections to such angular correlations has been developed (Phys. Rev. E 2014, June, Rongali and Alam). The evolution equations have been derived following the approach of Pseudo-Liouville operator. We demonstrated a measurable effect of such correlations on the transient dynamics of the homogeneous cooling state of a rough granular gas. A super-Burnett-order nonlinear constitutive theory for the plane shear flow of granular materials has been developed (J. Fluid Mech., 2014, Saha and Alam, revised) following Grad's moment method. This theory has been validated against molecular dynamics simulations of granular shear flow, showing excellent agreement for all transport coefficients with theoretical predictions from the dilute regime upto the freezing-point density. The predictions for the first normal stress difference is found to be good for the whole range of density. A generalized Fourier-law for granular heat flux has been derived for a dilute granular fluid via an expansion around the anisotropic Gaussian state. We show that the gradient of the deviatoric part of the kinetic stress drives a heat current and the thermal conductivity is characterized by an anisotropic second-rank tensor for which explicit analytical expressions are given.

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

Concentration fluctuations in bacterial suspensions: A particle-level simulation was developed to characterize the spontaneous long-wavelength instability in a quiescent swimmer suspension (Student: Mr. Deepak Krishnamurthy).

Continuous spectrum of the elastic Rayleigh equation: Using the framework developed by a former student (Dr.Anubhab Roy), we are in the process of characterizing the multiple continuous spectra of the elastic Rayleigh equation that is of relevance to both elastohydrodynamic and magnetohydrodynamic flows (Student: Mr. Shashikiran Reddy).

Effects of inertia on the motion of non-spherical particles: We are examining the effect of micro-scale inertia on the rotation of both prolate and oblate spheroidal particles. The role of inertia on both the choice of orbit (Jeffery) and the period of rotation is examined for small but finite Reynolds number. (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 is examined and a boundary-layer analysis is used to highlight the role played by closed-streamlines in the heat or mass transfer from the surface of the drop. The analysis aims 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

K R Sreenivas	Ph D

Honorary Professor

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

SERB Fellow/Honorary Professor

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

Professors

Rama Govindarajan	PhD, FASc, FNASc (on lien)
Meheboob Alam	Ph D

Associate Professor

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, Prasanth P, Dhake Milind Prakash, Thantanapally, Chakradhar, Deepak Krishnamurthy, Kanwar Nain Singh, Rashmi Ramaadugu, Deepthi S, Sankalp Nambiar, Jumpal Shashikiran Reddy, Vicky Kumar Verma, Mahan Raj Banerjee, Praveen Kumar K, Achal Mahajan, Mohammad Rafiuddin, Nakul Pande

NBHM- Post Doctoral Fellows

Shailendra Kumar Singh, Virendra Kumar

Research Associates

Aarthi Sekaran, Mahendra Shinde, Samrat Rao

Research Associate (Provisional)

Sachin Yashavant Shinde

R&D Assistants

Kanwar Nain Singh, Milind Prakash Dhake, Nakul Pande, Prasanth P, Rayan Chatterjee

Secretarial Assistant Trainee

H V Vijaylakshmi

Evolutionary & Organismal Biology Unit

During the year 2013-2014, the faculty of EOBU continued to conduct research in the broad areas of animal behavior, phylogeography, chronobiology, evolutionary genetics, neurogenetics, and population dynamics. Questions in the areas of (a) social organization in Asian elephants, (b) estimation of elephant population sizes through mark-recapture sampling, (c) biogeography of mammals in the Western Ghats, (d) communal roosting in common mynas, (e) comparative behavioural neurobiology, (f) neurogenetics of sleep, (g) fruit flies as a model system for neurodegenerative disorders, (h) circadian entrainment to temperature cycles, (i) study of circadian rhythms in nature, (j) evolution of adaptations to crowding, especially the interplay of food deprivation and waste buildup, (k) fruit fly metapopulation dynamics and stability, and (l) life history evolution are currently being addressed. The Unit also continues to train personnel in the area of whole organismal biology through the PhD, Integrated PhD and MS programmes, as well as through participation of the faculty in POBE and SRFP programmes of the JNCASR as well as similar outreach programmes run by the three Indian Science Academies and by DST and KVPY.

Ongoing research in the unit are in the areas of (a) social organization in Asian elephants, (b) estimation of elephant population sizes through mark-recapture sampling, (c) biogeography of mammals in the Western Ghats, (d) communal roosting in common mynas.

Salient research findings are listed below:

- Work on the social structure of female Asian elephants was continued in Nagarahole and Bandipur National Parks. It was found that elephant clans were stable across time but that there was a lot of fluidity within clans.
- Work on resource availability for elephants showed that resources were of the kind that could not be monopolized by single individuals, which may explain the lack of within-group dominance hierarchies. Elephant density in different habitats was similar despite the differences in the extent of elephant food plant availability, suggesting factors other than food resources as being important in habitat use.
- The population size, sex ratio, and social structure of elephants in Alur, Hassan district, Karnataka, were determined in order to provide management recommendations for this population in the high human-elephant conflict zone. A minimum estimate of 29 individuals, comprising males and distinct family groups, rather than a single clan of females, was arrived at through genotyping dung samples from the area. It was proposed that the animals be removed from the area and that the female groups be managed in different ways while maintaining their group integrity.
- The elephant population size of Phnom Prich Wildlife Sanctuary, Cambodia, was estimated using non-invasive sampling and mark-recapture techniques, and the area was found to be important for Asian elephant conservation in the region.
- A study on communal roosting in mynas showed that mynas were not recruiting conspecifics to the foraging ground, thus rejecting the recruitment centre hypothesis. Communal roosting was also not correlated with daytime predation, but it was possible that roosts were information centres.
- 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.
- Circadian clocks of early and late chronotypes in *D. melanogaster* have altered photosensitivity. Natural environment facilitates expression of true rhythmic behaviour in *D. melanogaster.* Time of adult emergence in *D. melanogaster* is an autosomal trait and is regulated by higher order genetic interactions. Temperature plays a major role in mediating phase of early and late chronotypes in *D. melanogaster*. Recovery from Jetlag in *D. melanogaster* is chronotype dependent.
- Olfactory receptor neurons (Or47b) mediate male-driven nocturnal sex drive and mating in fruit flies. Socio-sexual interactions have long-lasting after-effects on the circadian clocks of fruit flies.
- Olfaction-mediated social interactions in fruit flies time their daily repertoire. The significance of unique patterns in the circadian rhythms of fruit flies in nature have been examined.

- Circadian clocks partly mediate pre-adult development time in fruit flies *D. melanogaster*. Circadian clocks of flies developing faster also age faster. Faster development in fruit flies has fitness consequences.
- Strong-type (type-0) phase-resetting in circadian clocks of fruit flies *D. melanogaster* at low temperature.
- Fruit fly *D. melanogaster* populations reared for 200 generations under constant darkness show enhanced circadian photosensitivity.
- Simulating light and temperature cycles of nature in the laboratory reveals differential effects on activity/rest rhythm of *Drosophilids*.
- Ventral lateral neurons, previously identified by us a arousal promoting neurons increase day-time wakefulness by silencing sleep-promoting dorsal Fan shaped body neurons.
- Warmth sensitive ion channel expressing neurons modulate rhythmic activity/rest behaviour in opposite ways depending upon whether cyclic temperature cues are gated or gradual.
- Light regime experienced during pre-adult development modulates the rate of Huntington's disease progression in a fly model.
- Natural conditions override differences in emergence rhythms among closely related *Drosophilid* species.
- *Drosophila melanogaster* populations under laboratory selection show little evidence of classic 'selective sweeps' being the genetic underpinning of adaptation. Standing genetic variation appears to be the prime driver of adaptive evolution in such outbred, sexually reproducing populations.
- The effective population size of *Drosophila melanogaster* populations in the laboratory, of the type typically used for experimental evolution studies, has been estimated in the most accurate way till date, using a combination of census size and sex-ratio data and the distribution of female fecundity and male mating success. Laboratory populations of census size around 1500-1800 adults have effective population sizes of about 800-900.
- An hypothesis has been proposed to explain the simultaneity of stabilization of chaos to periodicity and attainment of spatial asynchrony in two patch metapopulations at moderate dispersal rates. The role of the balance between the effects of migration on altering the return map and making the slope less steeply negative at the equilibrium population size, and on inducing synchrony has been highlighted. Simulation studies of various components of the hypothesis are consistent with predictions.
- The relationship between local dynamics and migration rate is complex and these factors interact in their effect on stabilizing local dynamics and inducing synchrony/asynchrony in metapopulations. There are three zones of chaos, demarcated by r-values, that show differential sensitivity to the stabilizing effects of dispersal.
- Studies of *Drosophila melanogaster* populations adapted to larval crowding have shown that these populations have poorer fitness than controls under poor nutritional conditions, suggesting that the correlated responses to selection for competitive ability and adaptation to poor nutrition are asymmetric.
- Simulation studies with three different population growth models have shown that the exponents of Taylor's Law relating variance in population size to mean population size as a power function are greatly affected by the interaction between dispersal rate and local dynamics in a model-dependent manner. This is the first detailed study of the behaviour of Taylor 's Law exponents across a range of dispersal rates and local dynamics, and adds to the growing evidence that synchrony and local dynamics are both affected by an interaction between dispersal rate and the nature and form of the local dynamics.

The second batch of Integrated PhD students in the Unit have successfully completed two years of coursework and will begin research towards MS thesis.

Our 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 Fellow

Sheeba Vasu	Ph D

Senior Fellow

T N C Vidya	Ph D

Research Students

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, Avani Mital, Manaswini Sarangi, Abhilash, Lakshman, Manan Gupta, Mallya Shruthi Ramesh, Neha Pandey, Shambhavi Chidambaram, K Ratna, Goirik Gupta

Research Associates

B M Prakash, Bodhisatta Nandy, Koustubh M Vaze, Shahnaz Rahaman Lone

R&D Assistants

Sajith V S, Subhankar Chakraborty, Swetha K H, Jasnambika, Neha Pandey, Upasana Ganguly, Urvashi Jha

Geodynamics Unit

Current Areas of Research:

1. Active faults and geomorphic changes.
2. Dams in geodynamically active belts.
3. Tectonics and earthquake mechanisms along the Himalayan arc; geomorphology and climate evolution in the Himalayan region.
4. Tsunami hazardsand post-seismic processes and plate deformation along the Andaman-Nicobar subduction zone.
5. Intra-continental tectonics and earthquakes.

List of Current Projects (as PI and Co-PI)

1. Evaluating earthquake/tsunami recurrence along the Andaman arc from the study of shallow cores. Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.
2. IOC-UNWSCO project "Communicating the effects of the 1945 Makran tsunami to increase awareness and preparedness of tsunami hazards in the Makran region".
3. Indo-Australian project (between Indian Institute of Science and Melbourne University) on "Characterization of the seismic cycle in the central Himalayan seismic gap using precise U-Th dating of deformed speleothems" a project under Australia-India strategic research fund.
4. Paleoseismic history of the North Andaman from coral records, Ministry of Earth Sciences, Govt. of India.
5. Seismotectonic history, plate boundary deformation and state of stress in the Andaman-Sumatra subduction zone and its adjoining areas. Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.
6. Paleoseismic history of the North Andaman from coral records. Ministry of Earth Sciences, Govt. of India.

Educational and Outreach Activities

1. Member, DST Expert group on the 2013 Uttarakhand flood-causes and mitigation.
2. Convener, National Workshop on active fault mapping in India (funded by Ministry of Earth Sciences, Govt. of India).
3. Visit to Dept. of Earth Sciences, University of Melbourne, Australia in connection academic exchange program, Australia-India Strategic Research Fund.
4. International Conference on Geology of Himalaya, Karakoram and Tibet Region – The 28th Himalaya-Karakoram-Tibet Workshop, Tubingen, Germany 22-24, August, 2013.

Science Outreach Programme in Uttarakhand

Sponsored and funded by C.N.R.Rao Hall of Science, Organized and personally participated as a lecturing resource person in the following programme:

1. **Gangolihat, district Pithoragarh**: May 15 and 16, 2013

Colleges	:	19
*Students	:	124
Teachers	:	24

*Pre-university students of Classes XI and XII

The themes of Valdiya's lectures were:

(i) Earthquake and landslide hazads

(ii) Grave water scarcity problem and recharging mountain springs
(iii) Evolution of the Himalaya

Following are the members of Geo dynamics:

Head
Prof. K.S. Valdiya

Senior Associate
Prof. C.P. Rajendran

Research Associate
Dr. Jaishri Sanwal Bhatt

Molecular Biology and Genetics Unit

The Molecular Biology and Genetics Unit (MBGU) of the centre is well recognized for its research programme in biomedical and biological sciences. With eight laboratories conducting cutting-edge research, MBGU attracts some of the best students from all over India for its PhD and Integrated-PhD research and training programme. Research in the MBGU labs span diverse areas of biology. The current areas of research comprise infectious diseases, human genetic diseases, chromatin organization and transcription regulation, stem cells and cardiovascular development and molecular mechanism of chromosome segregation. Research programs in the unit are supported by grants from several national and international funding agencies and from biotechnology companies.

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.

Molecular Parasitology Laboratories

Research in this lab 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.

Human Molecular Genetics Laboratory

In a study of over 750 families with non-syndromic hearing loss, this lab 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. Collectively, mutations at these genes are responsible for about 40% of recessive,

nonsyndromic, sensorineural, severe-to-profound hearing loss in Indian populations. Indeed, about 25% of the hearing loss was found to be is due to mutations at a single gene, connexin 26 and the high prevalence of a particular connexin 26 mutant allele, W24X, was attributed to an approximately 8000-year old founder effect. Knowledge of the relative contributions of these genes to the load of hereditary hearing loss in Indian populations has helped devise a 'genetic algorithm' that has important implications for early detection of this disorder.

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. Using a whole genome-based linkage mapping approach, his laboratory has defined the critical genomic region between the markers D11S929 and D11S480, which is proposed to harbour a hitherto unknown deafness-causing gene.

Vascular Biology Laboratory

A comparative approach has been made by using embryonic stem cell models, mouse developmental biology and *Drosophila* genetics, to decipher the roles of novel genes expressed early in the cardiovascular and hematopoietic systems. Our approach has given useful insight into gene function as well as ontogeny of the heart, blood and blood vessels. Analysis of these genes in the context of human development as well as in clinical studies with a focus on tumor angiogenesis and progression has been undertaken. Current studies are focused on understanding mechanisms that control cardiovascular development using ESCs and mutant mice.

Recently two new sibling human embryonic stem cell (hES) lines from discarded embryos have been derived and differentiated to cardiovascular derivatives that can be cultured to purity. These are called BJNhem19 and BJNhem20 and have been deposited in the UK Stem Cell Bank. The lines are also listed on the European hESC registry. The laboratory is currently involved in the International Stem Cell Initiative (ISCI) project on accumulation of genetic defects in ES cell cultures.

Molecular Virology Laboratory

The laboratory screened a large number of Indian clinical samples and identified an immunodominant B-cell epitope in the cysteine-rich domain of Tat only in the HIV infected people. This finding has a direct relevance for HIV vaccine design. Differential transcription factor binding to several sites in the viral promoter has been delineated in subtype-C HIV-1 promoter region.

Transcription and Disease Laboratory

The research carried out by the research group led by Prof. Tapas K. Kundu during the period has led to the below findings out of which some have been reported in reputed international journals and some are in the process of publication:

a) It has been discovered that human histone chaperone NPM1, is able to relieve the centromeric histone H3 variant, CENP-A mediated repression of transcription from the chromatin template. It was also shown that NPM1 gets phosphorylated by Aurora kinases with functional consequences on the process of cytokinesis.

b) The multifunctional transcriptional coactivator PC4 has been found to be a novel substrate of Aurora kinases. Remarkably, it was discovered that PC4 is a potent activator of both Aurora kinases A and B. Apart from PC4, three novel substrates of Aurora kinases were discovered, which are transcription regulators and were seen to be playing an important role in the process of muscle differentiation.

c) It was discovered that the first known natural compound as specific inhibitor of the histone acetyltransferase, PCAF and elucidated the KAT activity dependent gene network involved in the process of muscle differentiation. Furthermore, recently a non toxic inhibitor of another class of histone acetyltransferases, p300/CBP was also synthesized. This work has thrown substantial light on the mechanism of toxicity through the ROS (reactive oxygen species) link to toxic KAT inhibitors.

d) Previously, the research group has discovered the first known p300 activator, CTPB. Based on this, the HAT activator TTK21 was synthesized, which has been conjugated with the glucose derived CSP. The CSP-TTK21 could activate transcription in the mice brain and thereby induce neurogenesis and memory formation in healthy mice. This entire work was possible through a successful collaboration between

the laboratory, Prof. M. Eswaramoorthy's (CPMU, JNCASR) group and Prof. Anne L Boutillier's group from France.

e) Earlier, it was shown that the natural compound, garcinol is a potent broad spectrum inhibitor of different Histone acetyltransferases. Recently, in collaboration with Dr. Gautam Sethi's group and Prof. J.M. Luk's group from National University of Singapore , it has been shown that garcinol can target the STAT3 pathway and effectively reduce the tumor growth in xenografted mice. This work has raised the possibility for the next phase of work with garcinol as a neoplastic therapeutic.

f) The laboratory has successfully generated two monoclonal antibodies against histone chaperone NPM1 and acetylated-NPM1. Both have been successfully commercialized by the famous U.S. based company, Merck-Millipore.

g) The research group has also found out, from the samples collected from across the globe, that the positive coactivator, PC4 is predominantly downregulated in breast cancer. The mechanisms behind this have been partially elucidated.

Molecular Mycology Laboratory

The reseasrchers in this Lab have studied centromeres of a pathogenic yeast, *Candida dubliniensis* and compared centromere sequences with those of a closely- related yeast *Candida albicans*. The studies indicate that centromeres are evolving at a rate faster than any other genomic region in these two species.

The laboratory also initiated a new programme to study the structure-function relation of centromeres in three Candida species: *C. albicans, C. dubliniensis and C.tropicalis* and to investigate the mechanism of this rapid change in centromere DNA sequence.

Structure-function analysis of centromeres of pathogenic yeasts Candida and Cryptococcus. Gene indexing and epigenomics in Candida albicans by histone H3 variants. Ploidy and pathogenicity - is there a connection? Molecular mechanism involved in rapid evolution of the centromere DNA sequence.

Programs launched during 2013-14

1) **INDO-FRENCH (CEFIPRA) Project:** "Mechanisms of Lysine Acetyltransferase (KAT/HAT) Activation by Small Molecule Activators and use thereof in Memory", Principal Collaborator (Indian) : Prof. Tapas K. Kundu; Principal Collaborator (French): Anne Laurence Boutillier, Cognitive Neuroscience Laboratory, France

2) **INDO-JAPAN Project:** "Mechanisms of Chromatin Repair: Role of Chromatin Associated Protein PC4 Acetylation by Tip 60", Indian Principal Investigator: Prof. Tapas K. Kundu; Japanese Principal Investigator: Prof. Kazuhiko Igarashi, Department of Biochemistry, Tohoku University Graduate School of Medicine, Japan.

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

SERB Fellowship

M R S Rao	Ph D F A Sc, F N A, F N A Sc, FTWAS

Professors

Anuranjan Anand	Ph D, F A Sc
Hemalatha Balaram	Ph D, F A Sc
Namita Surolia	Ph D, F A Sc, F N A Sc
Ranga Uday Kumar	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
James P. Chellaih	Ph D

Technical Officer (Veterinary)

R G Prakash	B V Sc & A.H.

Technical Staff

Anand Kumar K, Suma BS, Ushasree Pattamatta

Research Students

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, Palak Agrawal, Barve Gaurav Ramanand, T., Lakshmi Prasoona, Vikas, Shveta Jaishankar, Lakshmi Sreekumar, 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, Krishnendu Guin, Wulligundam Praveen, Rima Singha, Yamini Sharma, Dongre Aparna Vilas Pushpalata, Iyer Aditya Mahadevan, Surbhi Bhushan Dhingra, Devanshi Khare, Siddharth Singh, Pallabi Mustafi, Shubhangini Kataruka, Priya Jaitly, Veena A, Bhavana Kayyar

Research Associates

Abhishek Baghela, Aravinda K Chavalmane, Arti Baban Dumbrepatil, B Raghava, D Karthigeyan, Jeelan Basha, Mamata Mishra, Manjira Ghosh Kumar, Manoj Kumar, Mantu Rajbangshi, Pushpak Mizar, Ram Murthy A, Sadhan Chandra Das, Sarmistha Halder Sinha, Somnath Mandal, Sreyoshi Mitra, Sujata Kumari, Swati Sinha, Laxmi Narayan Mishra

Research Associates (Provisional)

Abhishek Sinha, Mahesh Bachu, Linda Alex, Manjulata Singh, Mitali Bhattacharjee

Research Associate III

Roshan Fatima Begum

Junior Research Fellows

Amogh Gopinathan Nair, K S Vinay, Mote Ridim Dadasaheb, S Santosh, Arghyashree Roychowdary, Diana Rodrigues, Kunala Jyothirmai, Sonia D Kulkarni

R&D Assistants

M. Sujoy Deb, Akshay V Bhat, Amol Bapurao Aher, Anayat Ullah Bhat, Asif Ahamad Bakshi, B K Viswanada Reddy, Chetan V Kurthukoti, Deepak Roshan V G, Deepak S, Gautam Chatterjee, Lalitha Saripalli, Mahadeva Swamy M M, Prathima B N, Rebu K Verghese, Rishikesh Gopal Lotke, S Manu, Saiprathap, Satya Krishna Pentakota, Shambhu Prasad G A, Shashank Rai, Shrinivas Nivrutti Dighe, Sourav Nayak, Sriram Kannan, Umesh T G, Tanmoy

Chakraborty, Anitha Sanjay Rokhade, Deepthi Sudarshan, Jasper Chrysolite Paul, Lavanya T, Monalisa Das, Mouli Chakraborty, Saihitha Veerapaneni, Shalini Harkar, Shiny joy, Surabhi Sudevan, Sweta Singh, Vandhana Devi, Nishitha Patel

Trainee

Ningmuankim

Secretarial Assistant Trainee

Lavanya M, Rashmi B

New Chemistry Unit

The New Chemistry Unit was created as part of the Centre's 11th Five Year Plan. The unit was inaugurated in presence of Prof. A.K. Cheetam, Prof. M. L. Klein, Prof. W. Jones and Prof. E. W. Meijer in December 2010 and works on interdisciplinary aspects of chemical science. The most important areas that are actively pursued are at the interface of chemical biology, chemical science and materials science. Some of the specific areas of research are solid state and materials chemistry, chemistry of metal chalcogenides, organic synthesis, biomaterials, organic and supramolecular chemistry, antimicrobial therapeutics, drug delivery systems, patternable polymers, conducting polymers, semiconducting nanomaterials, renewable energy, liquid interfaces, multifunctional metal-Organic hybrids, medicinal chemistry, theoretical chemistry, carbon and oxide based materials and catalysis.

The Unit currently has a few core faculty members with Prof. C.N.R Rao as its Chairman. Several faculty members from other Units are also associated with the Unit. The Unit admits students for Ph.D. degree programme as well as integrated Ph.D. in Chemical Sciences. The Unit also admits students for integrated M.S.-Ph.D. programme in Chemical Sciences through Project-Oriented Chemical Education (POCE). The students admitted for these programmes would undergo extensive course work, research and training before continuing for dissertation work.

Research progress reported during the financial year 2013-14 is as below:

Several aspects of the chemistry of materials are being pursued by *Prof. C. N. R. Rao*. For more than five decades, Prof. Rao has been working on transition metal oxides. He continues to work on some recent aspects of metal oxides. In particular, he is interested in anion substituted oxides wherein the oxygen is substituted by nitrogen and fluorine. Such substitution results in drastic changes in electronic structure and properties. He is continuing to conduct research on graphene and graphene mimics. Graphene mimics include a few layer or single layer materials formed by layered inorganic compounds such as MoS_2 and TaS_2. This has resulted in a wealth of new materials with possible applications. Novel synthesis of materials as well as exploration of new phenomena and properties exhibited by them are of interest to Prof. Rao. For example, he is now investigating properties of bismuth triiodide expecting it to be a topological insulator under pressure. A recent area of research Prof. Rao is involved in artificial photosynthesis based on inorganic nanomaterials. These studies include oxidation as well as reduction of water.

Dr. T. Govindaraju's research is at the interface of chemistry and biology. His group actively pursues the design and synthesis of small molecules, peptides, nucleic acids and their conjugates based biomimetic systems and materials through Nature-inspired molecular self-assembly approach. These biomimetic materials find applications as biomaterials, drug delivery systems, composites and in bioelectronics. Dr. Govindaraju is also involved in developing molecular probes for biosensing and bioimaging of variety of cations, anions, small biomolecules and bio-macromolecules such as proteins and nucleic acids through supramolecular host-guest interactions. They are undertaking the design and synthesis of new class of smart-building blocks for metal directed assemblies for biosensor and smart materials applications. His group has established protocols to develop biomimetic molecular self-assembly-based systems and materials through chiral transcription, amplication and retentive helical memory for use in chiral technology and to understand spontaneous deracemization and amplication pathways for biological homochirality. They are presently working in the area of neurodegenerative diseases (Alzheimer's, type 2 diabetes and Parkinson's, diseases) and nucleic acid chemistry (templated nucleic acid ensembles for drug targeting and delivery, biosensing and global nucleic acid structure and functional analysis).

Dr. Jayanta Haldar's research group has worked on multi-drug resistant Gram-positive bacteria like vancomycin resistant Enterococci (VRE) and Staphylococci (VISA and VRSA); as well as pan-drug resistant New Delhi metallo- β-lactamase-1 (NDM-1) producing Gram-negative bacteria which have become a threat to the global public health. The perennial persistence of bacterial resistance, calls for urgent need to develop more potent drugs having new mode of action, which would make bacterial resistance difficult to develop. Recently, novel

vancomycin analogues have been developed which could not only overcome acquired resistance against VRE, VISA and VRSA but also took care of the inherent vancomycin resistance towards Gram-negative bacteria. Unlike vancomycin, these vancomycin analogues showed the ability to stop the development of bacterial resistance due to incorporation of novel membrane disrupting mechanism. Another strategy has been developed where the membrane-active molecules were found to re-sensitize the tetracycline antibiotics to NDM-1 producing Gram-negative clinical isolates. It was observed that the membrane activity of the molecules provided a backdoor entry to the otherwise excluded antibiotics due to efflux pumps. A novel small molecular and macromolecular Antimicrobial Peptides Mimics have been created and shown that they inactivate various wild-type and drug resistant pathogenic bacteria and are having no in-vitro and in-vivo toxicity. Recently, new generation polymeric biomaterials have been engineered to make any surface antimicrobial, which inactivate various pathogenic bacteria completely on contact.

Dr. Kanishka Biswas's research group is directed towards the solid state chemistry; understanding structure-property relationship and electronic and phonon transport properties of metal chalcogenides. Main focus of his group is to develop highly efficient thermoelectric materials which can directly covert waste heat to electrical energy and will have a significant role in future energy management. Recently, his group have discovered a new class of materials, cubic I-V-VI_2 (where I = Cu, Ag alkali metal; V = Sb, Bi; and VI = S, Se, Te) semiconductors, which can posses very low thermal conductivity thus can give rise to high thermoelectric performance. In the last year, promising thermoelectric materials have been developed based on Pb-free $SnTe_{1-x}Se_x$ system, which has immense importance in industry. Dr. Biswas' group have also been involved in the synthesis of rare kinetic or polytype metal chalcogenide phases in the form of nanocrystals which can show fascinating electronic and phonon transport properties and phase transitions. Work has been undertaken towards developing the solution based synthesis of two-dimensional ultrathin topological insulators, which are expected to show exotic electronic and phonon transport properties. His research group is also involved in developing infrared detectors based on heavy metal chalcogenide nancrystals generated at liquid-liquid interface and understanding their in-situ growth kinetics by using synchrotron X-ray scattering.

Dr. Ranjani Viswanatha has been working extensively on doping transition metals into quantum dots and using them as nanosensors to probe the electronic structure of the host quantum dots. Theoretical methods have predicted varied results for the determination of the absolute energy levels of conduction and valence bands as a function of size and till date this has been poorly understood experimentally due to the lack of a simple technique. Using this novel technique, she has not only explored the conduction band and valence band variation as a function of size but has also opened up new ways to understand the role of ligands in passivating the surface as well as temperature dependence of band edge variation adding significantly to the understanding of electronic and optical properties of such systems. More recently, she has studied the defect states and correlated their contribution to the optical properties of the nanomaterials. While the experimental results are at first sight counter-intuitive, it has been explained and used successfully in device applications in her work. Theoretical understanding of the electronic structure in these defective nanocrystals have been used to shed light on these correlations.

Dr. Sebastian C. Peter has focused on research in solid state inorganic materials such as intermetallics, chalcogenides and polyoxometalates from exploratory synthesis. Discovered several new intermetallics, which are interest in terms of the structural diversity and physical properties. The low dimensional intermetallic materials have been successfully used as good catalysts in selected chemical reactions. Research on chalcogenide systems is aimed at developing materials for photovoltaic and non-linear optical properties, and rare earth doped chalcogenide glass materials for lasers and phase change memory devices. Also, the research in polyoxometalates is focused to look newer synthetic and self-assembly pathways and gaining a better insight in the mechanism of the interactions.

The underlying theme of *Dr. Subi George's research group* lies at the interface between synthetic efforts on -conjugated systems and the organization of these molecules using supramolecular self-assembly principles, with the ultimate aim of developing novel functional materials. The electronic, optical and self-assembling properties of the -conjugated backbone have been targeted for the design of materials. During the last year,

work has been undertaken towards the design of solution processable, luminescent organic-inorganic hybrids by the co-assembly ionic dyes and nanoclay particles. In addition, dipolar dyes have been synthesized for the design of self-assembled nanostructures with NLO and optical wave guiding functionalities. Research on supramolecular charge-transfer assemblies has been extended to impart them with novel properties like ferro-electricity. In addition, a variety of chiral assemblies have been synthesized, exhibiting amplified circularly polarized luminescence.

Dr. Ujjal Gautam's research group has been working on the area of nanoscience and nanotechnology, with a specific interest of generating functional nanomaterials for energy harvesting and other application purposes. Firstly, a model system is under development based on fullerene, C60, that is believed to provide key insight to the formation of nanostructures (self-assemblies in particular) in a solution. Based on the understanding of self-assembly, key organic molecules have been easily separate from one another, which is extremely difficult otherwise. Further to make use of these separated molecules in an energy sustainable and efficient manner, metal peroxide based reagents have been developed that can be recycled and used at a low operating temperature. Besides, efforts have been directed towards using nanostructures in energy harvesting.

Prof. H. Ila's research group has 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. The diversity oriented synthesis of these molecules relies upon development of new class of organosulfur building block i.e., precursor pool, which are readily accessible in a one-pot-reaction from a wide range of cheap active methylene compounds. 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 interest area of this research group revolves around design and development of new efficiency increasing one-pot-reactions such as domino reactions, multi-component reactions for accelerating discovery process. Recently, exploration of transition metal catalyzed C-C and C-heteroatom bond forming reactions for construction of novel heterocyclic scaffolds is in progress.

Prof. Swapan Kumar Pati's research group has investigated the possibility of 2D boron sheets (BS) as anode material in lithium ion battery (LIB). Among α, α1, and η4/28 metallic BSs, planarity is retained for α1 and η4/28 polymorphs after bilayer formation. The optimum anodic nature of 1 and 1-AA polymorphs has been suggested based on their electronic, structural and Li-adsorption/desorption studies. Research has been carried out theoretically on methods to extract H_2 molecules from Methane using improved catalytic activity of Rhodium mono-layer modified Ni(110) surface. The physisorption of various fullerences over graphene has been studied and thereby probing the charge transfer interactions between the fullerenes and graphene complexes. In the search of efficient adsorbent for HF gas without its chemical decomposition, experimentally synthesized point defect containing nitrogen-rich single vacant (SV) 2D sheets are studied using ab initio molecular dynamic simulations. The research group also found that the alignment of magnetic ions within the DNA helix creates a spin channel due to the efficient orbital interactions between the magnetic ions. For, human telomeric G-quadruplex, it was found that the unfolding of the qudruplex occurs via triplex intermediate.

Prof. A. Sundaresan's research group has done an in-depth investigation on the formation of internal electric field and its effect on ferroelectric polarization on a polycrystalline sample of multiferroic $TbMnO_3$. A complex spiral magnet, $BiMnFe_2O_6$ has been investigated for possible multiferroic properties. An ordered perovskite which was predicted to be multiferroic has been shown to non-ferroelectric.

Prof. M. Eswaramoorthy has shown that mesoporous silica having flexible nanopores have been prepared by non-covalent, Charge -Transfer based interactions. Using the same approach the surfaces of the nanopores have been made to show charge reversal and hence gating the ion-transport through the nanopores.

Dr. Sridhar Rajaram's research group has been made progress in understanding the reasons for the high efficiency of our newly developed PDI based solar cells. Tools have been developed for controlling the conformation of organocatalysts. Also, a novel route has been developed to design non-proteinogenic α-amino acids.

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, a multi-chromophoric hybrid system has been synthesized where exciplex emission is sensitized by energy transfer which is unprecedented. Extensively work is under progress on nanoscale MOFs for different application like bio-imaging, drug delivery and light harvesting. Recently, it was 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 Activity:

On the occasion of NCU Day on February 11, 2014, Prof. P. Balaram from Molecular Biology Unit, Indian Institute of Science, Bangalore has delivered the Third Annual Chemistry Lecture on "Learning from Protein Sequences: Chemistry at the Fringes of Biology".

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, FNA, F A Sc

Faculty Fellows

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

DST Ramanujan Fellows

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

Associate Faculty Members

Prof. Swapan K. Pati (Professor)
Prof. A. Sundaresan (Associate Professor)
Prof. M. Eswaramoorthy (Associate Professor)
Prof. A. Govindaraj (Honorary Associate Professor)
Dr. Tapas Kumar Maji (Associate Professor)
Dr. 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. Soumyabrata Roy, Manjeet Chhetri, Shubhajit Das, Anand Kumar Roy, Monali Moirangthem, Arkamita Bandyopadhyay, K. Rajasekhar, Mohini Mohan Konai, Krishnendu Jalani, Pallabi Haldar, Komal Prasad, Yelisetty Venkata Suseela, Debopreeti Mukherjee, Ananya Mishra, Rajkumar Jana, Ananya Banik, Promit Ray, Kushagra Gahlot, Saurav Chandra Sarma, Amit Bhattacharya, Paramita Sarkar, Mahima Makkar, Suchi Smita Biswas

Research Associates

Aravinda T, Atul Kumar Dwivedi, G Parameshwarappa, Oinam Bijeta Chanu

Research Associate (Provisional)

Aloke Kumar Ghosh

Senior Research Fellow

B Saraiah

R&D Assistants

Sasikumar, Abishek Kannan Iyer, Anand Raj, Arindom Chatterjee, Gowtham B.M, K V V Satyanarayana, Madhu Mohan Saga, Manjunatha N, Pradeep P Shanbogh, Pramod H, Pramod Patil K, R Bharathanatha Reddy, Deepti Kalsi, S Shanthini, Swathi N

Theoretical Sciences Unit

Research Accomplishments

Prof. Umesh V Waghmare's research group has predicated the thinnest known ferro electric material using first-principles calculation. Based on its semiconducting properties, development of dipolectronic devices has been proposed. The multiferroic behavior of elemental Se has been explained. Using MD simulations, epitaxial strain temperature phase diagram of PbTiO3 has been determined.

Some significant research findings of Prof. Shobhana Narasimhan's research group are: 1) A simple model was developed that can explain how the magnetoresistance changes with contact geometry in a molecular spintronics set-up; 2) A theory was developed to explain the role of s and p electrons in gold nanocatalysis; 3) Routes for functionalizing graphene and other carbon nanostructures so as to increase gas uptake were suggested; 4) Insight was obtained into the various contributions from different kinds of van der Waals interactions to physisorption on graphene; 5) It was shown that co-adsorption of gases can move patterns on surfaces into regions of the phase diagram that are more accessible to experiments.

In Prof. N. S. Vidhyadhiraja's research group, investigations of disorder and proximity effects in s-wave superconductors have been carried out by an MS student, Naushad Ahmad Kamar, who submitted his thesis in the beginning of 2014. Three papers have resulted from this work, two of which are under review and one is published. A new theoretical method for investigating strongly correlated electronic systems that incorporates multi-orbital effects, and Hund's coupling and also integrates density functional theory based first principles methods has been in development in our group for the last two years. In the last year, a comprehensive benchmarking of the method was carried out. A manuscript containing the details of this method and the benchmarks is in preparation. The entire code is being packaged and will be released under a GPL-like license, and also hoped that these codes will be found useful by a large section of the strongly correlated community. Layered heterostructures of strongly correlated systems is another area where serious progress has been made. Presently, a manuscript is being written wherein, the effects of disordered interfaces on the spectral dynamics of few layer systems and superlattices are reported. Investigations of valence fluctuations driven quantum critical phenomena in heavy fermion systems was published last year. In-depth studies of disorder and non-Fermi liquid behaviour in heavy fermions led to one publication and another manuscript is in preparation. A PhD thesis based on this work was submitted early this year by Mr. Pramod Kumar.

Research Group of Prof. Subir Das has been involved in problems related to equilibrium and nonequilibrium statistical mechanics. In this broad area, significant new understanding on the following specific issues have been obtained:

i. Dynamic critical phenomena in fluid phase transition.

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

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

iv. Phase behavior of systems containing active particles.

v. Effects of disorder in chemical reaction diffusion systems.

vi. Nucleation and growth of droplets in phase transitions.

vii. Pattern formation in Granular matter.

During the past academic year four students guided by Prof. Das defended thesis. 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 awarded by Jawaharlal Nehru University

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

3. Sutapa Roy; Ph.D. Thesis title: "Phase Transition Dynamics in Fluids: Equilibrium to nonequilibrium"; degree awarded by JNCASR

4. Saugata Patra; M.S.-Eng. Thesis title: "Numerical Investigation of Pattern Dynamics in Complex Ginzburg-Landau Equation"; degree awarded by JNCASR

Prof. Kavita Jain's research group has elucidated the connection between adaptive walk properties and the distribution of fitness effects. The stationary state properties of a population evolving under the joint action of selection, drift and recombination has been calculated.

Prof. Swapan K Pati's research group has investigated the possibility of 2D boron sheets (BS) as anode material in lithium ion battery (LIB). Among α, α1, and η4/28 metallic BSs, planarity is retained for α1 and η4/28 polymorphs after bilayer formation. The optimum anodic nature of α1 and η1-AA polymorphs has been suggested based on their electronic, structural and Li-adsorption/desorption studies. A method has been worked out theoretically how to extract H_2 molecules from Methane using improved catalytic activity of Rhodium mono-layer modified Ni(110) surface. The physisorption of various fullerences over graphene has been studied and thereby probed the charge transfer interactions between the fullerenes and graphene complexes. There are also many works on graphene and graphene quantum dots and their electronic and optical properties that have been extensively looked at. It was found that the interactions of graphene and ssDNA in water suggest that the graphene can be desolved in ssDNA solution with water. In the search of efficient adsorbent for HF gas without its chemical decomposition, experimentally synthesized point defect containing nitrogen-rich single vacant (SV) 2D sheets are studied using ab initio molecular dynamic simulations. It was also found that the alignment of magnetic ions within the DNA helix creates a spin channel due to the efficient orbital interactions between the magnetic ions. For, human telomeric G-quadruplex, it was found that the unfolding of the qudruplex occurs via triplex intermediate.

Teaching and Other Academic Activities:

The TSU admitted one student to join its PhD programme. About 4 students submitted doctoral thesis, and three students submitted master's thesis. Five coursed were taught by the TSU faculty that were taken by students in TSU, CMPU and NCU.

TSU joined as an equal partner with CPMU in conducting an integrated M.S.-Ph.D. programme in Materials Science with a strong flavour of Physics.

An In-House symposium of the TSU was organized on August 10, 2013. In this event, (a) new students were welcome, (b) faculty members gave talks on open problems and research opportunities in their areas of work, (c) students representing each group gave talks on their work, and (d) a large number of students and research staff presented posters on their research.

A number of TSU research seminars were organized by Prof. Subir Das on Tuesdays, that benefited a wide range of members in the JNC community.

TSU contributed to organization and teaching in the Cambridge-JNCASR Winterschool on "Frontiers of Materials" in December, 2013.

Prof. Vidhyadhiraja is on sabbatical leave for a year at Lousiana State University, USA (OCT 2013 –OCT 2014). An offer of a faculty position was made to Prof. Meher Prakash, who has accepted to join, and is expected to join by May 1, 2014. Drs. Subir Das and Kavita Jain were promoted to Associate Professorship. A new appointment of an office assistant (Mr Mahesh) was made.

A large number of high quality papers were published by the research groups in TSU, showing the continued excellence in research.

The following are the members of the Unit:

Chair

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

SERB Fellow/Honorary Professor

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

Kavita Jain	Ph D
N S Vidhyadhiraja	Ph D
Subir Kumar Das	Ph D

Research students

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, Pawan Kumar

Project Investigator

Siamkhanthang Neihsial

Research Associates

Madhuri Mukhopadhyay, Suman Majumder, Himadri Barman

Research Associates (Provisional)

Kapil Gupta, Pramod Kumar, Rajiv Kumar Chouhan, Shuvrajyoti Bhattacharjee, Venkata Srinu Bhadram, Sutapa Roy

Senior Reseach Fellow

Marathe Madhura Pradeep

R&D Assistants

Naushad Ahmad Kumar, Debarati Bhaumik, Jaysree Pan, Meenakshi Upadhyaya, Piyali Chakraborty, Saugata Patra, Somananda Sanyal

Junior R&D Assistant

Sakthi Veena

IISc – Research Associates

Ajoy Kumar Kandar, Jamshid Moradi Kurdestany, Shrutisagar D. Haveli

International Centre for Materials Science

The International Centre for Materials Science (ICMS), at the Jawaharlal Nehru Centre for Advance Scientific Research, is devoted to carry out high impact interdisciplinary research, promote collaborations, personnel exchange, organize discussions and meetings and promote education in Advanced Materials Science. ICMS was dedicated to the nation by Prime Minister of India Dr. Manmohan Singh on December 03, 2008. The Centre is financially supported by the Department of Science and Technology (DST), Government of India and directed by Professor C.N.R. Rao, F.R.S.

The ongoing research programs are Chemistry of Materials, Surface physics Soft Condensed Matter and Low-dimension materials and other aspects of Materials Science. The Centre now houses several sophisticated research facilities such as molecular beam, epitaxy and other growth system, ultra high resolution TEM and state-of-the-art optical, electrical and magnetic characterization probes.

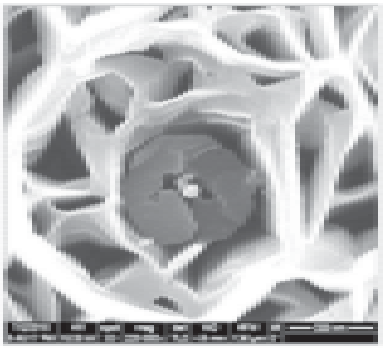
Research Highlights

Prof. C.N.R. Rao's group has initiated two major programmes: one related to, artificial photosynthesis involoving photocatalytic oxidation of water by Nanoparticles of Mn and Co oxides; and the other, on photocatalytic H_2 generatation by Semiconductor nanostructures by using the Z-scheme. Synthesis, Characterization and properties of anion substituted metal oxides where in oxygen is replaced by nitrogen and fluorine are being investigated.

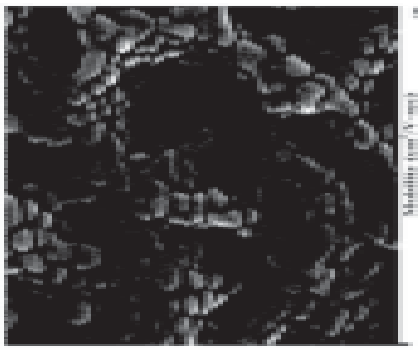
Prof. S.M. Shivaprasad at *Epitaxy Laboratory* is involved in forming thin films and nanostructures of III-nitride semiconductors with novel functionality and properties. We kinetically grow GaN, ALN and InN thin films, and their alloys, on Sapphire and Silicon substrates to filter dislocations, defects and strain in a Molecular Beam Epitaxy system to obtain self-assembled, epitaxial, catalyst-free nanostructures to tailor their properties. Surface modifications was employed such as superstructure and intermediate layer formation to optimize conditions for high optical, structural and electrical performance that are evaluated by several sophisticated complementary in-situ and ex-situ characterization techniques such as RHEED, XPS, HRXRD, HRTEM, FESEM, PL, CL, STM/AFM/MFM, Hall, SQUID, PPMS, etc.

Mechanisms were elucidated on the underlying evolution of nanowall-networks and dislocation mediated nanocolumns. Interesting and novel properties of the nano-configurations of GaN were shown such as enhanced photoemission, d^0magnetism, unprecedented electron mobility, coherent emission arrays, etc in these systems. The nanowalls were used as templates for nano-epitaxial-lateral-over-growth to obtain very low defect thin films of GaN and InN that display unprecedented high quality manifested as highest electron mobility values reported in the literature. Forming submonolayer coverage superlattices with integral matching with the substrate unit cells, it was possible to form GaN and InN thin films of better structural, optical and electrical properties at much lower temperatures employed in the past. Preliminary evidence have been gathered for using the nanowall route to form a novel 2D-Electron Gas system at room temperature. It was recently discovered that the high surface area nanowall network adsorbed with Silver nanoparticles as substrates for biomolecular detection, which have shown protein-charge insensitivity, uniform hot-spot distribution, high enhancement factor and very-low detection limit by Surface Enhanced Raman Spectroscopy.

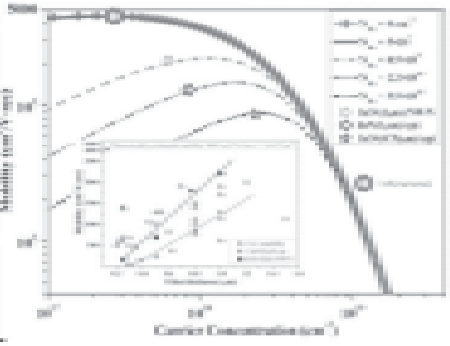
Research has been initiated of forming alloys of III-nitride thin films, on various polar and non-polar Sapphire and low and high index Silicon surfaces, to tailor make spatially periodic, self-assembled configurations with desired electrical and optical properties by tuning them by size-shape and band-gap engineering. It was planned to modify performance by conformal coatings on the nanostructures in the recently acquired Atomic Layer Deposition system. The efficacy of these novel materials were explored for applications in optoelectronics (LED, Lasers and Solar cells), spintronics and nanoelectronics (HEMT) in the new Clean-room facilities being established at our Centre.



Obervation of dislocation mediated GaN nanoclumn growth in nanowall-network



Adsorption of Ag nanoparticles on GaN nanowall - network for SERS bio-molecular detection



Plots showing our highest mobilizations of InN Films and nanorods in the literature

Dr. Ranjan Datta has worked on the below areas:

Magnetic characterization at the nano scale: Significant progress had been made towards quantitative magnetic information at the nano scale by electron magnetic circular dichroism (EMCD) technique. Signal improvement and site specific magnetic information have been obtained for various spinel oxide system.

Quantitative imaging: Progress has been made on quantitative imaging of oxygen atom occupancy by aberration corrected high resolution transmission electron microscopy. More work need to be carried out before any publication.

Optical nanoscopy: Band gap and their types have been successfully evaluated at the nano scale from various cation ordering in different spinel oxide system. Couple of papers has been under revision towards this contribution.

π -doping in ZnO: p-doping in ZnO was successful after 3 years of research in this area. Prototype bi-polar device will be fabricated based on this.

In the *Soft Matter Lab* of *Dr. Rajesh Ganapathy,* research was mainly focused on the following themes: 1. Understanding yielding mechanisms in soft amorphous solids, 2. Glass transitions driven by random pinning, and 3. Elucidating the mechanism that govern shear-thickening in suspensions of anisotropic colloidal particles. Apart from these, integration of a rheometer was done to an ultra fast camera to image fast processes during the yielding of athermal amorphous solids.

Dr. Sridhar Rajaram's research group has developed twisted perylenes as alternatives to fullerenes. The photophysical properties have been studied using Transient Absorption Spectroscopy and also studied the aggregation behavior of these molecules by embedding them in ferroelectric polymers. Apart from this, the effect of conformational constraints in organocatalysts was explored and a novel method for the synthesis of amino acids was developed.

Dr. Ranjani Viswanatha has worked on doping transition metals into quantum dots and using them as nanosensors to probe the electronic structure of the host quantum dots. Theoretical methods have predicted varied results for the determination of the absolute energy levels of conduction and valence bands as a function of size and till date this has been poorly understood experimentally due to the lack of a simple technique. Using this novel technique, the conduction band was explored along with valence band variation as a function of size. As a result of this, new ways have opened up to understand the role of ligands in passivating the surface as well as temperature dependence of band edge variation adding significantly to the understanding of electronic and optical properties of such systems. More recently, the defect states was studied and correlation was established with their contribution to the optical properties of the nanomaterials. While the experimental results are at first sight counter-intuitive, it has been explained and used successfully

in device applications in her work. Theoretical understanding of the electronic structure in these defective nanocrystals have been used to shed light on these correlations.

International Collaboration and other developments

The centre has established several collaborations and has signed Memorandum of Understanding with leading international research institutions such as Weizmann, SISSA, RMIT –Australia, Waterloo Canada, under which there are constant exchanges of students and researchers along with frequent technical meetings and workshops. The centre is a member of several International fora like EICOON, WMRIF and IUSSTF.

ICMS has established the major scientific user facilities to serve both in-house researchers and researchers from other institutions and has further expanded its infrastructure with Atomic Layer Deposition, PPMS, Nanofabrication lab, Analytical Facility, Sonicators, Bridgman Furnace, Powder XRD System, Maskless Lithography System, another FESEM, Reactive-ion etching (RIE), Physical vapor deposition (PVD), Superconducting Quantum Interference Device (SQUID), Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES), UV Spectrometer, Photoluminescence Spectrometer (PL), etc. The "Thematic Unit of Excellence on Computational Materials Science" is being set up in the new CCMS building as an extension of The Centre for Computational Materials Science (CCMS) of ICMS.

ICMS supports PhD and MS degree programmes, Short-term visits and offers Post-graduate Diploma in Materials Science. It offers Senior and Junior Fellowships under RAK-CAM Programme and also Short-term visiting programmes. The students admitted by JNCASR under PhD and MS programmes based on their performance in interviews also get an opportunity to use the state of the art facility, attend national/ international conferences, meetings and visit other universities under various collaborative and exchange programmes. 6 Students have graduated under the two semesters (one year) Post Graduate Diploma in Materials Science programme. Three students are currently enrolled in this programme.

Special annual seminars series and other events

The International Materials Lecture is an annual lecture series by eminent scientists from all over the world. This series has also been well appreciated and successful. The Sixth International Materials Lecture was delivered by Prof. Mercouri G Kanatzidis, Northwestern University, December 2, 2013.

The Annual Materials Lecture initiated in 2011, is another annual lecture series delivered by eminent scientists from all over India. The Third Annual Materials Lecture was delivered by Prof. Ashutosh Sharma, Indian Institute of Technology, Kanpur, on April 8, 2013.

The Sheikh Saqr Materials Lecture series: The third annual "Sheik Saqr Materials Lecture" will be delivered by Professor Sir Andre Geim, FRS Kt, University of Manchester on December 4, 2013. The fourth lecture of this series was delivered by Prof. John Pethica, FRS, Physical Secretary & Vice-president, The Royal Society London, on March 26, 2014.

ICMS also organizes seminars, schools, workshops and conferences in collaboration with colleagues in JNCASR and elsewhere. ICMS has also sponsored various schools and workshops conducted by other organizations.

1. Indo-Australia joint workshop on Smart Materials in collaboration with RMIT Workshop, January 28-29, 2013
2. Indo-Israel Conference on Advanced Materials, in collaboration with Weizmann University and Mahatma Gandhi University, Kerala January 30, 2013 to February 5, 2013
3. Chemistry Symposium in collaboration with RSC, February 7, 2013
4. Research Conference on Chemistry of Functional Materials, CFM-2013, Goa, August 28-30, 2013
5. .Annual Materials Research Conference, Kerala, October 11-13, 2013.

6. Winter School on "Frontiers of Materials Science" with University of Cambridge, UK and SSL, December 2-6, 2013.

7. Symposium on Fragility in Glass Formers, January 5-8, 2014

Inauguration of the Sheikh Saqr Laboratory

The Sheikh Saqr Laboratory located in the new CCMS building was inaugurated on August 26, 2013. His Highness Sheikh Saud Bin Saqr Al Qasimi was conferred with the Honorary Fellowship of JNCASR for his significant contribution and vision towards the cause and development of science, education and materials research and for establishing the Sheikh Saqr Laboratory at JNCASR. The Sheikh Saud lecture hall, equipped with 3-D and 2-D projection facility was also inaugurated by His Highness Sheikh Saud Bin Saqr Al Qasimi.

The SSL grant has supported the setup of following laboratories: Atomic Layer Deposition, PPMS, Clean room for Nanofabrication, X-Ray Diffraction, Analytical facility, Rheology of soft matter, Synthesis of organic electronic devices, Computational Facility and Practical class room

The Sheikh Saqr Laboratory is headed by Prof. C. N. R. Rao, Director, ICMS. Prof. Anthony K. Cheetham, Chairman of RAK-CAM's Scientific Advisory Board, will hold the title Sheikh Saqr Distinguished Visiting Professor and the Faculty of ICMS and others working in materials science at JNCASR are associated with SSL. This grant also supports expenditure related to positions such as Research Associates, Technical Assistants and R&D Assistants.

The following fellowships have been awarded to

Sheikh Saqr RAK CAM Senior Fellow

Prof. Shobhana Narasimhan
Prof. Balasubramanian Sundaram

Sheik Saqr Career Award Fellows

Dr. Subi George
Dr. T. Govindaraju

Sheikh Saqr Student Fellows

Mr. Anushuman J. Das
Ms. Urmimala Maitra
Mr. Rana Saha
Mr. B.V.V.S. Pavan Kumar

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

Amitha Shetty, Jayaramulu Kolleboyina, Nagaraja K K

Technical Assistants

Prajwal D J

Diploma Students

Renu Tomar, Ankit Kumar Sharma, Manju Unnikrishnan

Graduated students (Post Graduate Diploma Programme)

Jyothirmayee Kandula, Shikha Dwivedi

R&D Assistants

Gururaj Hosmani, Sunil Kumar, Renu Tomar, Srishti Arora

Junior Lab Assistant

Munegowda

Visiting Scientists

Mr. Adalikwu Stephen Adie

Dr. M. Ashraf Shah

Dr. Mohd. Ikram

Dr. Donourou Diabate

Mr. Ukoba, Kingsley Ogheneova

Mr. Onumashi Afi

Dr. Ibrahim Mohd. Nassar

Shiek Saqr Laboratory

Research Associates

Chithaiah P, Sanyasinaidu Boddu

Technical Assistant

Shivakumar K M

Thematic Unit of Excellence in Computational Materials Science

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

Research Accomplishments

A Monte Carlo simulation program (software) has been indigenously developed which can be used to study phase equilibria of molecular substances, primarily liquids and gases. Within the grand canonical ensemble, this code has also been used to predict adsorption isotherms of gases (of small molecules) on surfaces, slit-pores and in porous solids including metal organic frameworks and conjugated microporous polymers.

The self-assembly of chromophoric molecules in organic solvents is of vital interest in light harvesting applications. The energetics of supramolecular oligomerization of such molecules in gas phase and in organic solvents using quantum and classical approaches have been studied. The importance of dipole-dipole interactions in such systems has been shown through undertaken research.

Work on transition metal DNA complexes and their interesting electronic and magnetic properties has been undertaken. The catalytic processes has been investigated by which H_2 molecules can be obtained by degradation of a CH_4 molecule over inexpensive metal surface. Graphene with nitrogen cavity has been found to be a good material to physisorb the pollutant like HF. A 2D Boron sheet has been found as an excellent anode material for Li-ion battery application. Various exotic quantum phases have been found within a low-dimensional magnetic/Bosonic system.

Detail theoretical analysis of 1-dimensional transition metal di-chalcogenides was carried out with focus on electronic and vibrational properties. Ferroelectricity in the 1T polymorph of MoS_2 was also demonstrated, making it the world's thinnest known ferroelectric semiconductor. Based on this, a new class of "dipolectronic" devices have been proposed.

Point defects in twisted bilayer graphene have been studied using DFT. The weak adsorption of hydrogen on carbon nanostructures too have been studied. Magnetoresistance of a system of dithienylethene molecule between spin polarized nickel has been studied for spin transport applications. The co-adsorption of Br_2 and H_2 on Si(001) have also been investigated using DFT calculations.

Meetings held

1. Inaugural function of 'One day workshop on Computational Materials Science' at Department of Studies in Physics, Manasagangotri, Mysore. January 24, 2014.

2. Mini workshop on 'Special topics in Density Functional Theory' at JNCASR. Organized by Prof. Shobhana Narasimhan. May 12-14, 2014.

3. DFT School at IISER Pune (organized by IISER Pune jointly with JNCASR). Prof. Shobhana Narasimhan, Co-organizer. June 30 – July 12, 2014.

Equipments and Lab facility:

Presently, three computers clusters in a data center of 450 sqft area are maintained and functional:

- 4 Tera Flops (7 years old) High Performance Cluster named "Sampige"
- 6.5 Tera Flops (4 years old) HPC named 'Booruga'.
- 10.6 Tera Flops (1.5 years old) HPC named 'Taavare' procured and set up under the current TUE-CMS project.

Works have commenced for the establishment of state-of-art 1800 sq. ft., Tier-II datacentre to house high performance computers, including a new 80 Tflop one, which is expected to start functioning by November 2014.

Publications

Year 2012: 34 papers

Year 2013: 50 papers

Year 2014: 36 papers

Following are the members of the Unit:

Coordinator
Prof. Balasubramanian Sundaram FASc

Members
Shobhana Narasimhan FNASc
Swapan K Pati FNASc, FASc
Srikanth Sastry FNASc, FASc
Umesh V Waghmare FNASc, FASc, FNA
Meher Prakash

Staff
K Venkatesh, T Basavaraj, Vijay Amirtharaj A, Ananda Raman A

Research Staff

Dr. Anant D Kulkarni, Research Scientist D (Program Support)
Devina Sharma, Research Associate
Piyali Chakraborty, R&D Assistant

Thematic Unit of Excellence on Nanochemistry

Research Progress

New synthetic strategies for nanomaterials and investigating properties leading to applications are the two important aspects, currently pursued in the Unit. The synthesized nanomaterials include size and shape controlled metal and semiconductor nanocrystals, functionalized carbon nanotubes, graphene and its derivatives as well as analogues, metal and semiconductor nanowires, nanocomposites, semiconductor wall-like structures, organic as well as biomaterials.

Various wet chemical routes are being employed for the synthesis of pristine and doped semiconductor Nanocrystals. Their size-dependent electronic and optical behavior are being investigated in detail. Porous nanomaterials and metal/metal oxide nanoparticles have been synthesized which are being used in catalytic reactions such as NOx removal, methane conversion and selective oxidation of hydrocarbons.New classes of porous metal-organic frameworks solidsare being examined for their potential applications in gas storage, separation and catalysis; they also possess interesting optical and magnetic properties.The synthesis of clay-based nanocomposites such as clay-metal nanoparticles and clay-polymer composites with interesting properties is another area of our interest.

Other unique materials being investigated are graphene and functionalisedgraphene. Inorganic graphene analogues such as metal sulfides and BCN have also been synthesized and well characterized. Properties of some of these materials are being investigated in devices, e.g. supercapacitor, field emitter, and radiation detectors. Nanocarbons as potential materials for storage of hydrogen and other gases are being studied.

Surface physics at sub-monolayer coverage and molecular beam epitaxy of thicker films have been combined to produce epitaxial 2D films and nanostructures of III-nitrides. The formed nanostructures have been well characterized using sophisticated characterization tools such as RHEED, Ellipsometry, XPS, LEED, Photoluminescence, High Resolution XRD, etc. A highlight of this study is GaN based nanowall network structure, which exhibits photoluminescence confined to voids between the walls.

Patterning of metals using predesigned templates has led to large area wire networks. These networks have been used on transparent substrates to effectively replace ITO in optoelectronic devices. Supramolecular systems in the nanofibres containing donor-acceptor molecules have been self-assembled and used in FETs and humidity sensors. These activities are being carried out in the newly built Nanofabrication facility.

The bionano-activities are extended to identifying and developing new functional nanomaterials for intracellular drug delivery. Developing intracellular carriers that have no barriers across the cell membranes and nuclear membranes could find potential therapeutic applications. It has been found that glucose derived carbon nanospheres are intrinsically fluorescent and can be used as a carrier for nuclear delivery. Design and synthesis of small molecules, peptides, nucleic acids and their conjugates based biomimetic systems have also been carried out. Nanotechnology based smart drug delivery systems for addressing nonspecific action and toxicity related issues of existing drugs are currently under study.

Following are the members of this Unit:

Faculty

Dr. Ranjan Datta

Dr. M. Eswaramoorthy

Dr. Rajesh Ganapathy

Dr. Ujjal Gautam

Dr. Subi Jacob George

Dr. A. Govindaraj

Dr. T. Govindaraju

Dr. Jayanta Haldar

Prof. G. U. Kulkarni

Dr. Tapas Kumar Maji

Prof. K.S. Narayan

Dr. Sebastian C. Peter

Dr. Sridhar Rajaram

Prof. C.N.R. Rao

Prof. S.M. Shivaprasad

Prof. A. Sundaresan

Dr. Ranjani Viswanatha

Technical Assistance

N. R. Selvi, Govindan Kutty

Computer Laboratory (CompLab)

During 2013-14 following major activities were undertaken by the CompLab:

Network upgradation: In last few year bandwidth requirements for both internet as well as intranet as increased quite a lot. Furthermore, with increased complexity of the network and cyber attacks to the network happening on regular basis, it was felt that we need a highly secure network with high bandwidth for internet/intranet. In this regards following activities were completed by the CompLab:

1 Internet bandwidth enhancement to 250 MBPS.

2 Upgradation of the existing intranet network in JNCASR campus to 10 GbPS.

3 Centralized wireless throughout the campus

4 Introduction of network management system

5 Installation of Web access firewall and other security related software/hardware.

6 Implementation of more secure DHCP network (activity under progress and expected to finish in few weeks)

7 Migration towards IPv6 from IPv4 protocol ((activity under progress and expected to finish in 3 months)

Central Printing facility: The centralised printing facility has been set up with a high-speed network color copier. All users have been assigned a fixed print quota for a month depending on their requirement. With this facility, users are able to give print commands online from anywhere in the Campus.

Central Server Management system: The server management system has been set up in order to ensure better security and redundancy of servers in a single platform. Majority of the equipments have been put on Active-Active mode of redundancy . The aim of this system is to avoid server failures in the Campus.

Following are the members of CompLab:

Head, CompLab

Dr. Santosh Ansumali Ph D

Consultants

D. Mahendravarman, Vikas Mohan Bajpai

R&D Assistant

Kanak Joshi Ambekar

Trainee

Sampad Biswas

Library

The Library presently has a collection of over 8700 books and access to over 5000 scientific journals. 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 2013-14	358
Total books in collection	8765
Journals	
Online journals subscribed	173
Print journals subscribed	6
New online journals subscribed	5
Approx. price for new journals	Rs.7,52,081/-
Patent database (Derwent Patent Index) – from National Knowledge Resource Consortium	1
Abstracting and Indexing database from National Knowledge Resource Consortium	Web of Science, SciFinder
Online journals in collection (Subscription + consortium resources)	Over 5000

Books Acquisition

In the financial year 2013-14, 358 books worth Rs. 11,53,862/- (Rupees Eleven lakhs fifty three thousand eight hundred and sixty two only) have been procured based on the recommendations of faculty members.

Journal Subscription and Consortium Resources

The total amount spent for the subscription of both print and online journals for the year 2013-14 is Rs. 1,66,22,763/- (Rupees One crore sixty six lakhs twenty two thousand seven hundred and sixty three only). Five new journals have been subscribed worth Rs.7,52,081/- (approx.).

Due to financial constraints, some key resources supported by National Knowledge Resource Consortium have been discontinued for 2014 such as Annual Review journals.

New Journal Subscriptions

1. ASM Alloy Phase Diagram
2. Frost & Sullivan Data base
3. Learning & Memory
4. Journal of Immunology
5. Journal of Infectious Diseases

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 205 article requests have been fulfilled through inter-library cooperation. Five articles were purchased online.

Following are the library staff members:

Library-cum-Information Officer
Nabonita Guha

Sr Library cum Information Assistant Gr.I
Nandakumari, E.
Nagesh Hadimani

Library cum Information Assistant
Senthil Kumar, N.

Library Trainee
Poornima Hosamani

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 30/11/2014)

Hindustan Lever Chair

S Chandrasekaran
Indian Institute of Technology, Madras
(Term: 01/11/2011 to 15/11/2015)

Vikram Sarabhai Research Professor

Kalyan B Sinha — F N A, F A Sc
Jawaharlal Nehru Centre for
Adanced Scientific Research, Bangalore
(Term: 01/12/2011 to 31/03/2014)

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 M.S./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.

(a) Research Admissions

During the August 2013 admissions, 44 students have joined JNCASR under different degree and diploma programmes and during the mid-year admissions of 2013-14 for the session which commenced on 1 January 2014, 3 students joined the Centre for Ph.D. degree. The current student strength at JNCASR is 278. The advertisement for the regular admission to the Integrated Ph.D., Ph.D. and M.S. programmes 2014-15 session was released in all the prominent national and regional newspapers and announced on our website.

(b) 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 2013- March 2014:

M S (Engg.)	M S (Materials Science) of Int. Ph D Degree	M S in Biological Science of Int. Ph D degree	M S in Chemical Science
Saugata Patra	Ankush Kumar	Joydeep De	Arkamita Bandyopadhyay
Pramoda K	Ram Kumar	Avani Mital	K Rajasekhar
Sorathiya Shahajhan Hassanali	Sisir Maity	Manaswini Sarangi	
Thantanapally Chakradhar	Chandan Kumar	Geetanjali Prabhakar Vaidya	
	Chandan De	Vikas	
	Anirban Mondal	Shveta Jaishankar	
	Koushik Pal	Lakshmi Sreekumar	
		Surabhi Sudevan	
		Sunaina Singh	

Ph D Degree	
Sabyasachi Mukhopadhyay	Vishwas V
Koustubh M Vaze	Shiladitya Sengupta
B. Mahesh	B.R. Rakshith
Nisha N K	Mukti Nath Mishra
Sudip Mohapatra	Suman Majumder
Babhrubahan Roy	Madhura Marathe Pradeep
Arup Chattopadhyay	Anshuman Jyothi Das
Sujata Kumari	Narendra Kurra
Prakash Parida	Sandeep Kumar Reddy
H S S Rama Krishna Matte	Laxmi Narayan Mishra
Mamta Jain	Pankaj Yadav
Nishtha Pandey	Abhishek Sinha
Anubhab Roy	D Karthigeyan

Postgraduate Diploma in Materials Science (PGDMS)	**Postgraduate Diploma in Science Education (PGDSE)**
Sharvani Shivaprasad	Sunita Belwadi
Bolla Govinda Rao	Madhuri Chauhan
	Aysha N

(c) Student Awards

- Dr Rama Krishna Matte was the recipient of the Best thesis under Physical Sciences category for the year 2012-13.
- Dr Babhrubahan Roy was the recipient of the Best thesis under Biological Sciences category for the year 2012-13.
- Mr Thantanpally Chakradhar received the Roddam Family Award for the Best M.S. thesis in Engineering Mechanics.

Short-term Academic Programmes

(a) Postgraduate Diploma in Science Education (PGDSE): Centre had received 203 applications for the advertisement of PGDSE programme during April 2013. The committee after interviews selected 2 students to join this programme. They joined the Centre on 1 August 2013 and have been assigned to faculty.

Sl. No	Name	Areas	Faculty
1	Jyothirmayee Kandula	Chemistry	Prof. Chandrabhas N
2	Shikha Dwivedi	Chemistry	Prof. G.U. Kulkarni

These students will be completing their course requirements by July 2014.

(b) Postgraduate Diploma in Materials Science (PGDMS): The Centre on behalf of ICMS (International Centre for Materials Science) had admitted 3 students during the session August 2013-14 after screening 84 applications and interviewing the shortlisted candidates.

Sl. No	Name	Areas	Faculty
1	Ankit Kumar Sharma	Chemistry	Prof. Shivaprasad
2	Renu Tomar	Chemistry	Dr. Ranjani V
3	Manju Unnikrishnan	Chemistry	Dr. T Govindaraju

These students are expected to complete their course requirements by July 2014.

The advertisement for the Postgraduate Diploma in Materials Science and Postgraduate Diploma in Science Education will be released during April 2014.

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. Bangalore Evolution Group Meeting, Dr. Kavita Jain, April 25, 2013.
2. Update on Cell Sorting Applications and BD Facsaria™ Users Meet, BD-JNCASR Centre for Advanced Learning in Flow Cytometry Forum, April 26, 2013.
3. Science outreach programmes - Summer, Prof. K.S.Valdiya, May 15-16, 2013.
4. Conference on "Being social: an inter disciplinary conference on social behaviour", Prof. R. Sukumar, IISc, June 28, 2013.
5. Theme Meeting on Materials Chemistry, Convenor: Dr. R. Vijayaraghavan, VIT University, Vellore, July 25-27, 2013.
6. 2nd Joint Indo - South Africa PMGC Meeting, August 01-03, 2013.
7. 9th JNC Research Conference on Chemistry of Materials, Convenor: Dr. Subi J George, October 14-17, 2013.
8. FCBS Workshop for Postgraduate Students and Teachers, Convenor: Prof. M.V. George, October 23-25, 2013.
9. Numerical many body methods for quantum systems in chemistry & physics, December 8, 2013.
10. IUMRS - ICA 2013, December 16 - 20, 2013.
11. Molecular Immunology Forum meeting, January 9 - 11, 2014.
12. Short term course in Materials Science, January - February, 2014.
13. DST Animal Sciences PAC Meeting, February 14-16, 2014.
14. The 17th Transcription Assembly Meeting, organised by Prof. Tapas K Kundu (JNCASR), Prof. Dipankar Chatterji (IISc) and Prof. V. Nagaraja (IISc), March 17-18, 2014.
15. Visit of Indo-French delegates, March 17, 2014.

Endowment Lectures

1 **A.V. Rama Rao Lectures in Chemistry:** Computational Chemistry: From Molecules to Functional Materials, Speaker: Dr. Sourav Pal, NCL, Pune; Prize Lecture: Supersonic Experimental Techniques: Defining Hydrogen Bond and Reducing Ignition Delay, Speaker: Dr. E Arunan, IPC, IISc, April 29, 2013.

2 **Prof. V. Ramalingaswami Memorial Lecture:** "The Science and Art of making Vaccines", Dr. Maharaj Kishan Bhan, Former Secretary, Department of Biotechnology (DBT), Government of India, July 18, 2013.

3 **Prof. C.N.R. Rao Oration Award Lecture:** "Exotic Patterns in Driven Granular Matter", Prof. Meheboob Alam, Engineering Mechanics Unit, JNCASR, August 7, 2013.

4 **Linus Pauling lecture: "Science Shapes Our Future"**, Prof. Ryoji Noyori, Nobel Laureate, President, RIKEN, September 16, 2013.

5 **DAE-Raja Ramanna Lecture in Physics:** " Extreme Light, Hot Electrons and Laser Fusion", Prof. G. Ravindra Kumar, TIFR, Mumbai. Prize Lecture: "Orbital ordering in transition metal oxides - a route to high polarization multiferroics", Prof. Priya Mahadevan, S.N. Bose National Centre for Basic Sciences, Kolkata, September 20, 2013.

6 **6th International Materials Lecture**: Prof. Mercouri G Kanatzidis, Northwestern University, December 2, 2013.

7 **3rd Sheik Saqr Materials Lecture:** Prof. Sir Andre Geim, FRS Kt, University of Manchester, December 4, 2013.

8 **Darwin Lecture:** Detecting the footprint of natural selection from genomic patterns of variation, Prof. Brian Charlesworth, FRS, Institute of Evolutionary Biology, University of Edinburgh, UK, February 20, 2014

9 **4th Sheikh Saqr Materials Lecture:** Nanomechanics, Prof. John Pethica, FRS, Physical Secretary and Vice-President, The Royal Society, London, U. K., March 26, 2014.

Silver Jubilee Lectures

1. **Silver Jubilee Inaugural Lecture:** Celebration of Science, Prof. CNR Rao, National Research Professor, Linus Pauling Research Professor & Honorary President, JNCASR, November 18, 2013.
2. Balancing the Budget: what drives the global circulation of the oceans?, Prof. Ross Griffiths, Research School of Earth Sciences, The Australian National University, December 13, 2013.

Special Lecture

Annual Materials Lecture : Materials at Interfaces: Anatomy and Physiology of Soft Adhesion, Prof. Ashutosh Sharma, Department of Chemical Engineering, IIT, Kanpur, April 08, 2013.

Conferences / Workshops / Symposia

1. FACS Aria Workshop, April 22-24, 2013.
2. Workshop on ethics in scientific research, Dr. Vinayaka Prasad, Albert Einstein College of Medicine, New York, August 13, 2013.
3. JNCASR Silver Jubilee In-house symposium, November 18 - 20, 2013
4. Magnetism in diluted magnetic semiconductors: From homogeneous systems to nanoscale inhomogeneities, Dr. Akash Chakraborty, School of Engineering and Science, Jacobs University Bremen gGmbH, Campus Ring 1, 28759 Bremen, Germany, November 21, 2013.
5. International Meeting on Challenges & Opportunities in S&T in Developing Countries, TWAS ROCASA, JNCASR, November 21-23, 2013
6. Optical and hydrodynamical effects in chiral nanostructures and their interplay, Prof. Ambarish Ghosh, Centre for Nano Science and Engineering (CeNSE), Indian Institute of Science, Bangalore, November 25, 2013.
7. National Fluorescence Workshop (FCS 2013), November 26 - 28, 2013.
8. Flow Cytometry Workshop - 2, organised by The Flow Cell at MBGU, JNCASR along with BD Biosciences and Flowcytometry Solutions Pvt Ltd (FlowSols), November 28–29, 2013.
9. International Conference on Directions in Materials Science, JNCASR, November 30 - December 1, 2013
10. Winter School - 2013 on Frontiers in Materials Science, December 2 - 6, 2013.
11. IUMRS-ICA 2013, Prof. S.B.Krupanidhi, IISc, December 16-20, 2013.
12. International Symposium on 'Fragility of Glass Formers 2014', January 5 - 8, 2014.
13. 27th International carbohydrate symposium of the international carbohydrate organization (C10), January 12 - 17, 2014.
14. IUTAM Symposium, January 20 - 24, 2014.
15. 3rd International Conference on Physics at Surfaces and Interfaces, February 24 - 28, 2014.
16. TWAS ROCASA International Conference of Young Scientists on Recent Trends in Physical and Biological Sciences, March 7-8, 2014.
17. Two days National Workshop on Frontiers in Chemistry, March 20 - 21, 2014.

Seminars/Colloquia

1. The elastic and elastocapillary Landau-Levich problem, Dr. Harish Dixit, Post-doctoral scholar, The University of British Columbia, April 10, 2013.
2. SERS targets cancer: the future looks BRIGHT? Dr. Naveen Gandra, Department of Mechanical Engineering and Materials Science, Washington University, St. Louis, MO, USA, April 04, 2013.
3. The size control mechanism of a dynamic organelle, Dr. Dibyendu Bhattacharyya, Advanced Center for Treatment Research & Education in Cancer (ACTREC), Tata Memorial Centre, Mumbai, April 05, 2013.
4. Statistical mechanics of disordered systems, Prof. Erica Carlson, Physics Department, Purdue University, USA, April 05, 2013.
5. Fluctuation of dihedral angles in biomacromolecules: thermodynamics of conformational changes and signature of allostery, Mr. Amit Das, S. N. Bose National Centre for Basic Sciences, Kolkata, April 09, 2013.
6. The Cell Cycle and the Circadian Clock: Dynamics of two coupled cellular rhythms, Prof. Albert Goldbeter, Faculté des Sciences Université Libre de Bruxelles Campus de la Plaine, Brussels, Belgium, April 17, 2013.
7. Micromechanics of emergent patterns in plastic flows, Dr. Anirban Sain, Physics Department, IIT-Bombay, Mumbai, April 19, 2013.
8. Designing Magnetoelectric Multiferroics with ABO_3 Perovskite Oxides as Building Blocks, Dr. Saurabh Ghosh, School of Applied & Engineering Physics, Cornell University, Ithaca, New York, USA, April 29, 2013.
9. A structural distortion induces ferroelectricity, weak-ferromagnetism, and bulk magnetoelectricity in the hexagonal manganite structure, Dr. Hena Das, School of Applied and Engineering Physics, Cornell University, Ithaca, New York, April 30, 2013.
10. On a Tight Leash: Control of Antimicrobial Defences and Inflammasomes by GBP Family GTPases, Dr. Avinash R. Shenoy, Department of Microbial Pathogenesis, Yale University School of Medicine, New Haven, CT, USA, May 02, 2013.
11. Martensitic phase transitions and compatibility, Mr. Vivekanand Dabade, Aerospace Engineering & Mechanics, University of Minnesota, Minneapolis,MN, USA, August 8,2013.
12. Dissolution driven convection for carbon dioxide sequestration: the stability problem, Prof. Shreyas Mandre, Assistant Professor, The School of Engineering, Brown University, August 14, 2013.
13. Work Fluctuations and the Second Law of Thermodynamics, Professor K. P. N. Murthy, School of Physics, Director, Centre for Integrated Studies, Centre for Modelling, Simulation, and Design (CMSD) University of Hyderabad, Hyderabad 500 046, Andhra Pradesh, INDIA, May 03, 2013.
14. Chromatin dynamics during mouse primordial germ cell development, Dr. Roopsha Sengupta, Research Associate, Surani Lab, Gurdon Institute, University of Cambridge, May 6, 2013.
15. Earth-Abundant Semiconductor Nanotube/Nanorod Arrays for Light Harvesting Applications, Dr. Karthik Shankar, Dept. of Electrical & Computer Engineering University of Alberta Edmonton, May 6, 2013.
16. Spatial structures and Giant Number Fluctuations in models of active matter, Professor Dibyendu Das, Associate Professor Physics Department IIT Bombay, Powai, Mumbai 400076, India, May 14, 2013.
17. DNA-Directed Assembly of Nanoparticle Superlattices for the Construction of Plasmonic Materials, B Radha, CPMU, JNCASR, May 20, 2013.
18. Fractal Signatures in Multi-Scale Domain Morphologies, Prof. Varsha Banerjee, Department of Physics, Indian Institute of Technology Delhi , New Delhi - 110016, India, May 28, 2013.

19. Chromosomes spatially reorganize while repairing their DNA damages, Prof. B J Rao, Senior Professor, Department of Biological Sciences, Tata Institute of Fundamental Research, May 29, 2013.

20. Micromanaging neuronal network : Role of neuronal wiring and plasticity by microRNAs, Dr. Sourav Banerjee, Associate Professor, National Brain Research Center, Haryana, June 07, 2013.

21. Life is organic chemistry, Prof. H. Ila, JNCASR, June 25, 2013.

22. Lasing in Photonic Crystal Microcavities, R.Vijaya, Dept of Physics, IIT Kanpur, July 19, 2013.

23. Magnetism in diluted magnetic semiconductors: From homogeneous systems to nanoscale inhomogeneities, Dr. Akash Chakraborty, School of Engineering and Science, Jacobs University Bremen gGmbH, Campus Ring 1, 28759 Bremen, Germany, August 1, 2013.

24. Nanosheet and granular structures for electrochemical energy storage, Prof. Timothy S. Fisher, School of Mechanical Engineering and Birck Nanotechnology Center, Purdue University, West Lafayette, IN USA, August 5, 2013.

25. Nanowire-Photonics with Plasmons and Excitons, Dr. G.V. Pavan Kumar, Photonics and Optical Nanoscopy Laboratory Departments of Physics and Chemistry Indian Institute of Science Education and Research, Pune, August 14, 2013.

26. Journey from DNA double helix to intelligent biocompatible surface, Dr. Banani Chakraborty, Alexander Von Humboldt Post Doctoral Fellow , Institut for Organic Chemistry, RWTH Aachen University, Aschen, Germany, August 19, 2013.

27. Divergent polarity in leaf growth and its regulation by miR396, Prof. Utpal Nath, Microbiology and Cell Biology Department, IISc, Bangalore, August 27, 2013.

28. Asexual Evolution (Through the Lens of Theory), Dr. Nisheeth K Vishnoi, Microsoft Research India, Bangalore, September 10, 2013.

29. Rational Design of Functional Materials using Soft Matter Self-Assembly as a Tool, Dr. Ramanathan Muruganathan, Materials Scientist Center for Nanophase Materials Science Oak Ridge National Laboratory Oak Ridge, TN 37831. USA., September 11, 2013.

30. Functional Nanomaterials for Energy Storage and Conversion,Dr. Vinodkumar Etacher, Department of Chemistry, Michigan Energy Institute, University of Michigan, USA, September 17, 2013.

31. Genomic Instability in Cancer: lessons from spindle assembly checkpoint regulatory network, Susanta Roychoudhury, Indian Institute of Chemical Biology, September 19, 2013.

32. Taking shape: how Drosophila renal tubules make their way, Prof. Helen Skaer, Professor of Developmental Biology, University of Cambridge, September 27, 2013.

33. Fracture, adhesion and locomotion of soft materials, Animangsu Ghatak, Professor, Department of Chemical Engineering Indian Institute of Technology, Kanpur, India,October 4, 2013

34. Two Species Semipermeable Exclusion Processes, Dr. Arvind Ayyer, Department of Mathematics, IISc. Bangalore, October 15, 2013.

35. Microhydrodynamics lectures, Prof.Ganesh Subramanian, JNCASR, October 18, 2013.

36. Exploring Electronic Structure of a Few Biomolecules and Graphitic Materials, Mr Arun Kumar Manna, TSU, JNCASR, October 22, 2013.

37. Transcriptional control of cell fate and circuitry in the brain, Prof. Shubha Tole, Professor, Department of Biological Sciences Tata Institute of Fundamental Research, Mumbai, October 29, 2013.

38. Flow Transitions in Turbulent Thermal Convection, seen from Mechanical Energy Budget, Prof. Ross W. Griffiths, Research School of Earth Sciences Australian National University Canberra, Australia, December 12, 2013.

39. Modelling and analysis of surface and boundary layer processes in weak and strong wind conditions, Prof. Maithili Sharan, Center for Atmospheric Sciences, Indian Institute of Technology Delhi, New Delhi, February 05, 2014.

40. Asymmetric Aza-Morita-Baylis-Hillman reaction: A useful strategy for the preparation of heterocyclic compounds, Prof. Akio Kamimura, Department of Applied Molecular Bioscience, Graduate School of Medicine, Yamaguchi University, Japan, October 30, 2013.

41. Understanding pure electronic and ionic systems via computer, Dr. Rajaraman Ganesh, Institute for Plasma Research, Bhat, Gandhinagar, October 31, 2013.

42. Attenuating Innate Immunity in Stroke: From Animal Models to Bedside, Dr. Thiruma Arumugam, Associate Professor, Yong Loo Lin School of Medicine Department of Physiology, NUS, November 13, 2013.

43. Scales and Scaling in Convective Turbulence, Prof. Jayanta Bhattacharjee, Harish-Chandra Research Institute, Allahabad, November 26, 2013.

44. Metaplastic regulation of synaptic co-operation and competition and its implications in physiology and pathology of long- term memory, Dr. Saji Kumar Sreedharan, Assistant Professor, Neurobiology Programme, Department of Physiology Centre for Life Sciences (CeLS), National University of Singapore, December 2, 2013.

45. Understanding Cancer Biology Using Genomic Approaches; and Translating to Medicine, Dr. Amit Dutt, Assistant Professor & Principal Investigator, Tata Memorial Centre, ACTREC, Navi Mumbai, December 10, 2013.

46. Efficient enhancement of circularly polarized luminescence from chiral molecular aggregates, Prof. Tsuyoshi Kawai, Nara Institute of Science and Technology, Japan, December 12, 2013.

47. Insights from statistical irregularities in finance, Prof. Matteo Marsili, Senior Research Scientist, Abdus Salam ICTP, Trieste, December 17, 2013.

48. Phenotypic constraints drive the architecture of biological networks, Dr. Areejit Samal, The Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy, December 17, 2013.

49. Teaching Science as Blind Faith vs. Rational Inquiry, Prof. K. P. Mohanan, IISER, Pune, December 19, 2013.

50. What decides the charge carrier mobility in small organic molecule based semiconductors and organic transistors: Disorder or Correlation?, Dr. Subhasis Ghosh, School of Physical Sciences, Jawaharlal Nehru University, New Delhi, December 23, 2013.

51. Electrode materials for lithium ion batteries, Dr. M. V. Venkatashamy Reddy, Department of Physics and Materials Science & Engineering, National University of Singapore (NUS), Singapore, December 24, 2013.

52. Dye Aggregates for Organic Electronics and Photovoltaics, Prof. Dr. Frank Wuerthner Universitaet Wuerzburg, Center for Nanosystems Chemistry & Institut für Organische Chemie, Wuerzburg, Germany, December 31, 2013.

53. DP103, a new player in NF-*k*B-induced breast cancer metastasis, Dr. Alan Prem Kumar, Assistant Professor, Department of Pharmacology, Yong Loo Lin School of Medicine, National University of Singapore, January 8, 2014.

54. Targeting Signal Transducer and Activator of Transcription (STAT)3 Signaling Pathway for Prevention and Therapy of Hepatocellular Carcinoma: Evidence from cell based and preclinical studies, Dr. Gautam Sethi, Assistant Professor, Department of Pharmacology, Yong Loo Lin School of Medicine, National University of Singapore, January 8, 2014.

55. Boolean and Non-Boolean Computation with Spin Devices, Prof. Kaushik Roy, Purdue University, West Lafayette, January 9, 2014.

56. Characterizing VLS-Grown InP: Simulation and Experiment, Prof. Peter Bermel, Purdue University, West Lafayette, January 9, 2014.

57. Advanced Dynamic AFM Methods for the Nanoscale Characterization of Complex Materials, Prof. Arvind Raman, Purdue University, West Lafayette, January 9, 2014.

58. Nanomaterials for Sensing, Diagnosis & Drug delivery applications, Prof. Suresh Bhargava, RMIT University, Melbourne, Australia. January 9, 2014 .

59. The origins and functional consequences of ETS gene fusions in prostate cancer, Ram Shankar Mani, Research Investigator, Department of Pathology, University of Michigan, USA, January 10, 2014.

60. Structural and vibrational aspects in III-V Nitride Nanostructures, Dr. Sandeep Dhara, Materials Science Division, IGCAR, Kalppakam, January 15, 2014.

61. Evolution of predatory cannibalism in Drosophila melanogaster larvae, Dr. Roshan Vijendravarma, University of Lausanne, January 17, 2014.

62. Functional Analysis of Human Breast Cancer Susceptibility Genes, Shyam K Sharan, Senior Investigator and Deputy Director, Mouse Cancer Genetics Program, National Cancer Institute at Frederick, Frederick, MD, January 27, 2014.

63. Asymmetric Reactions Using Bifunctional HB-Donor Catalysts 2. Development of new powerful HB-donor organocatalysts, Prof. Yoshiji Takemoto Graduate School of Pharmaceutical Sciences, Kyoto University, Japan, January 27, 2014.

64. Raw betel-nut induced genomic changes and chromosome instability leading to cancer, Prof. Anupam Chatterjee, Department of Biotechnology, North-Eastern Hill University, Shillong, January 28, 2014.

65. Defining the HIV-1 subtype B and C X4/R5 genotypes beyond the envelope, Dr. Brian Wigdahl, Department of Microbiology and Immunology, Drexel University College of Medicine, USA, February 3, 2014.

66. HIV-1 Tat genetic variation, drugs of abuse, and neurocognitive impairment, Dr. Michael Nonnemacher, Department of Microbiology and Immunology, Drexel University College of Medicine, USA, February 3, 2014.

67. Imaging Simian immunodeficiency in real time in vivo. Harnessing total body viral distribution, dynamics and reservoirs, Prof. Francois Villinger, Department of Pathology & Laboratory Medicine, Emory University School of Medicine, February 4, 2014.

68. Simple Molecules and Simple Chemistry Yield Complex Materials through Self-assembly, Prof. Richard G. Weiss, Department of Chemistry, Georgetown University, Washington, DC, February 7, 2014.

69. Optogenetic Approaches in Neuroscience, Dr. Govindaiah, Research Scientist, Beckman Institute for Advanced Science and Technology, University of Illinois, February 18, 2014.

70. Cancer immunoediting: Integrating the role of FoxP3 in cancer progression, Prof. Gaurisankar Sa, Bose Institute, Kolkata, February 18, 2014.

71. Detecting the footprint of natural selection from genomic patterns of variation, Prof. Brian Charlesworth, FRS, Institute of Evolutionary Biology, University of Edinburgh, UK, February 20, 2014.

72. Systems biology : From proteins in a cell to neural circuits in a brain, Dr. Nitin Gupta, Post-doctoral Scholar - Neuroscience, National Institute of Health, Bethesda, USA, February 21, 2014.

73. Non-coding and coding function of a single mRNA dictates skin homeostasis in wound healing and cancer, Dr. Gopinath M, Post-doctoral Scholar, Institute of Medical Biology, Singapore, February 28, 2014.

74. New collaborations of formins in actin assembly and organization, Dr. Richa Jaiswal, Department of Biology, Brandeis University, Waltham, MA, USA, March 3, 2014.

75. IFN-I Programs Innate Myeloid Dynamics and gene expression in the Virally Infected Nervous System, Debasis Nayak, National Institute for Neurological Disorders and Strokes (NINDS), NIH, USA, March 11, 2014.

76. Using transformative coarse-graining methods to unravel sub-cellular and cellular processes in biological systems at multiple length and time scales, Dr. Anand Srivastava, University of Chicago, March 12, 2014.

77. Introduction to Majorana modes in one-dimensional systems, Prof. Diptiman Sen, Centre for High Energy Physics. Indian Institute of Science. Bangalore, India, March 18, 2014.

78. Structure-function-property correlations in blend films of perylene diimide: polymer composites for photovoltaic applications, Dr P. E. Keivanidis, Intra European Marie Curie Fellow - Team Leader Centre for Nano Science and Technology at Polimi Istituto Italiano di Tecnologia Via Giovanni Pascoli, Milano, Italy, March 18, 2014.

79. Thermal Plasticity of Body & Organ Size in Drosophila melanogaster: Developmental Physiology, Genetics, Genomics & Quantitative Variation, Dr. Shampa M. Ghosh, Head, Centre for Innovation in Genomics & Informatics, Bionivid Technology Private Limited, March 20, 2014.

80. Needle Free Injection Technology in Your Hands Today, Dr. Rick Stout, Executive Vice President, Chief Medical Officer, Bioject Inc, USA, March 20, 2014.

81. Viral determinants of HIV associated neurocognitive disorders, Prof. Vinayaka Prasad, Albert Einstein College of Medicine, USA, March 21, 2014.

82. Evolutionary Host-Parasite Interaction in Plasmodium vivax Malaria Infection in India, Dr. Aparup Das, National Institute of Malaria Research, New Delhi, March 22, 2014.

Hindi Week

Hindi Week was celebrated from 17-25 September 2013. Series of events were organized on this occasion such as comedy/mimicry show, antakshari competition, Hindi workshop, Hindi quiz competition, etc.

Annual Faculty Meeting and In-house Symposium

A year long celebration of JNCASR Silver Jubilee Year has begun on November 2013. Annual Faculty Meeting and Silver Jubilee In-House Symposium was organised on 18-20 November 2014. As the Inaugural event, a music concert by Sarod Maestro Ustad Amjad Ali Khan and his sons Amaan and Ayaan was held on the 12th November 2013.

FELLOWSHIPS AND EXTENSION ACTIVITIES

Visiting Fellowship Programme

Six visiting fellows were selected for the Visiting Fellowships Programme 2013-14 under the Physical Sciences categories:

Sl. No	Name & Present Position/ Employment	Faculty
1	Dr. Venkatnarayan Ramanathan Sr. Assistant Professor, Sastra University, Thanjavur	Prof. Chandrabhas Narayana
2	Dr. Ashish Prabhakar Yengantiwar Assistant Professor, Fergusson College, Pune	Prof. G.U. Kulkarni
3	Dr. Sunil Mukundrao Patange Assistant Professor, Shrikrishna Mahavidyalaya, Gunjoti, Osmanabad	Prof. C.N.R. Rao
4	Dr. R. Srinivasan Associate Professor, P.S.R. Engineering College, Sivakasi, T.N	Prof. A. Sundaresan
5	Dr. Amshumali Mungalimane Assistant Professor, Vijayanagara Sri Krishnadevaraya University, Bellary	Dr. Sebastian C Peter
6	Dr. T.J. Sarvoththama Jothi Assistant Professor, NIT, Calicut	Prof. K.R. Sreenivas

Summer Research Fellowship Programme (SRFP)

The advertisement for SRFP 2014 was released in eight major newspapers and announced on JNCASR website. 2,156 applications were received out of which seventy three scholarships are offered. Majority of students under this fellowships are assigned to JNC faculty members and few are assigned to faculties from institutions across the country. Under this programme, the students receive a scholarship of Rs 6000 per month along with applicable travel incidentals.

Category	No. of applications received (for 2014)	No. of fellowships offered in 2014	No. of fellowships offered in 2013	No. of fellowships utilized in 2013
Life Sciences	720	24	25	16
Engineering Sciences	380	14	14	10
Atmospheric Sciences	94	0	2	1
Physical Sciences	470	10	11	4
Chemical Sciences	220	21	17	14
Mathematics	178	3	2	2
Materials Science	94	1	2	1
Total	2156	73	73	48

Project Oriented Chemical Education (POCE)

Seven students of POCE-2011-13, who had completed the programme successfully, are enrolled to M.Sc. degree programme in different institutions of the country, whereas one student is continuing her B.Sc. B. Ed in REC, Jaipur. Two students of POCE batch of 2008-10 have joined Ph. D programme in U.S.A and one student has joined the National University, Singapore for Ph. D.

Two students of POCE batch of 2009-11 have joined Ph. D. programme in U.S.A and one student is pursuing higher studies at Netherlands.

One student of POCE-2010-12 has joined Ph. D. program in U.S.A. Remesh Haridasan (POCE 2011-13) who had worked with Dr. Peter Sebastian is a co-author of a research publication.

One student of POCE-2013-15 had worked with a faculty member during the winter vacation period of December 2013.

In order to reach more number of good students from geographically remote places or small towns, Fellowships and Extension Office had sent information sheets along with a copy of the application form to around 200 principals with a request to bring the information to the notice of students studying in B.Sc. first year and to encourage the students to apply for POCE programme.

During the period from July 2013 to January 2014, CNR Rao Hall of Science-ETU-SOP has conducted eleven workshops on,"Experiments using College Chemistry Kit" for P. U. Sc. students of different parts of Karnataka. Each participating college was given one "College Chemistry Kit" as a gift for further use in the college. In all, 256 students and 16 teachers had participated in the workshops.

Project Oriented Biological Education (POBE)

Advertisement for the year 2014-17 program was released in January in 10 leading news papers and on our web site. In response, the Centre had received 345 applications. The POBE classes for the batch of 2014 are scheduled to commence on 15 May 2014. The batches of 2012 and 2013 are expected to return during the same period or earlier. Some of the students have come and worked with the MBGU and EOBU faculty under different laboratory projects during their breaks. Some of the students are also coauthors in publications coming from various labs of the Centre. The program has been highly successful and most of our past POBE students have chosen research as their career. Several of them have found placements in top notch universities in Europe and America and some in reputed institutes in India.

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

This Fellowship programme, jointly instituted by the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) Bangalore and the Centre for International Co-operation in Science (CICS), Chennai, is 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. Under this programme, 28 candidates have been selected since 2010. Of these, 7 have been given certificates on successful completion of their training programme at institutions across the country. For the fellowship programme of 2013, 8 fellows were selected; of which 2 have completed, 3 cancelled and 3 are expected join this year.

Seven Fellows have been selected under the JNCASR-CICS Fellowship Programme for the year 2014-15:

No	Name	Country
1	Mr. Ajay Kumar Yadav	Nepal
2	Mr. Gabriel kojo Frimpong	Ghana
3	Mr. Lateef Gbenga Bakre	Nigeria
4	Mr. Oyesola Oyewole Ojewunmi	Nigeria
5	Mr. Peterson Mwesiga	Uganda
6	Mr. Taddesse Yayeh Yihun	Ethiopia
7	Ms. Salma Kamal Hassan	Sudan

Guides for the above mentioned Fellows will be assigned after receiving acceptances from the Fellows.

National Science Day

The Centre celebrated the National Science Day on 28 February 2014. Around 200 students and faculty from schools and colleges had participated in the Science Day celebrations. The faculty from the Centre gave talks on topics as diverse from genes, cancer, chemistry, life personalized medicines, animal behavior, to energy. The students and the faculty had a very pro-active interactive session with the faculty after each talk.

Intellectual Property

Well-functional and balanced IP system is a key for promoting innovation and creativity, which in turn drives economic development of knowledge-based economies (KBEs). In such KBEs, strong linkages between industry and research institutions leads to a favourable environment to deliver platform technologies for translation into affordable services/products. The Centre fosters strategic creation/generation, protection and exploitation of intellectual property and has an enabling mechanism through the Intellectual Property Management Committee [IPMC]. To date, 165 (India-58, PCT-36, USA-36, Europe-14, Japan-6, China-5, S.Africa-2, Korea-2, Brazil-2, Australia-2, Vietnam-1, Israel-1) patent applications have been filed and obtained 28 (India-6, USA-15, Europe-3, S.Africa-2, Australia-1, Korea-1) patent grants, in addition to registering one Industrial Design and One Trade Mark.

During the year, the IPMC reviewed a number of new inventions and recommended filing of 26 patent applications (Indian Provisional Application-11, International Patent Application under PCT-8, USA-4, Japan-1, China-1 and South Korea-1) and obtained 7 Patents {USA-5, Korea-1 and Europe-1 (received intimation regarding intension of granting patent)} for commercialisable inventions meeting the patentability criteria.

The details are as follows:

Patent Applications Filed

I. Indian Patent Applications

Provisional applications filed for the inventions of:

1. Govindaraju Thimmaiah (Appl. No. 2258/CHE/2013, filed on 23/5/2013).
2. Kavassery Sureswaran Narayan, Subi Jacob George, Kotagiri Venkata Rao and Ravichandran Shivanna (Appl. No. 3058/CHE/2013, filed on 8/7/2013).
3. Sebastian Chirambatte Peter and Pradeep Prasannamurthy Shanbogh (Appl. No. 3317/CHE/2013, filed on 25/7/2013).
4. Govindaraju Thimmaiah, Kolla Rajashekhar, Ravi Manjithaya, Piyush Mishra, Santhi Natesan Suresh and Nagarjun Narayanaswamy (Appl. No. 3712/CHE/2013, filed on 21/8/2013).
5. Jayanta Haldar, Yarlagadda Venkateswarlu, Goutham Belagula Manjunath and Mohini Mohan Konai (Appl. No. 4314/CHE/2013, filed on 23/09/2013).
6. Narayan Kavassery Sureswaran, Zade Sanjio Shankarrao, Asatkar Ashish Kumar and Senanayak Satyaprasad Premswarup (Appl. No. 1066/KOL/2013, filed on 13/9/2013).
7. Kulkarni Giridhar Udapi Rao, Ritu Gupta, Shanmugam Kiruthika, Kunala Durga Mallikarjuna Rao, Mikkel Jorgensen and Frederik Christian Kerbs (Appl. No. 4608/CHE/2013, filed on 11/10/2013).
8. Muthusamy Eswaramoorthy, Kesavan Subaharan, Bosukondaveera Venkata Suryapavan Kumar (Appl. No. 5156/CHE/2013, filed on 13/11/2013).
9. Ujjal Kam Gautam and Moumita Rana (Appl. No. 5299/CHE/2013, filed on 18/11/2013).
10. Jayanta Haldar, Jiaul Hoque, Goutham Belagula Manjunath and Padma Akkapeddi (Appl. No. 5893/CHE/2013, filed on 17/12/2013).
11. Jayanta Haldar and Mohini Mohan Konai (Appl. No. 1345/CHE/2014, filed on 13/03/2014).

II. International Patent Applications under PCT

1. Title of the invention: A Composition Comprising Nanosphere And Histone AcetylTransferase (HAT) Activator, Processes and Methods Thereof.
   Inventors: Tapas Kumar Kundu, Anne-Laurence Boutillier, Snehajyoti Chatterjee, Muthusamy Eswarmoorthy, Puspak Mizar, Chantal Mathis, Jean-Christophe Cassel, Romain Neidl, Mohankrishna Dalvoy Vasudevarao and Vedamurthy Bhusainahalli Maheswarappa. Application No. PCT/IB2013/053343, filed on 27/4/2013

2. Title of the invention: Nanoparticle Compositions Of Antibacterial Compounds And Other Uses Thereof.
   Inventors: Jayanta Haldar, Divakara Siva Sathyanarayana Murthy Uppu, Akkapeddi Padma and Goutham Belagula Manjunath. Application No. PCT/IB2013/055518, filed on 5/7/2013

3. Title of the invention: Assay to Monitor Autophagy.
   Inventors: Ravi Manjithaya and Piyush Mishra. Application No. PCT/IB2013/058996, filed on 30/9/2013

4. Title of the invention: Monoclonal Antibodies against NPM1 and Acetylated NPM1, and Process Thereof.
   Inventors: Tapas Kumar Kundu, Parijat Senapati, Gopinath Kodaganur Srinivasachar, Deepthi Sudarshan, Manjula Das, Smitha Pazhoor Kumaran, Manjunath Shivasangappa Devaraman and Ajithkumar Sumitrappa. Application No. PCT/IB2013/058998, filed on 30/9/2013

5. Title of the invention: A Method of Oxidizing an Organic Compound.
   Inventors: Chintamani Nagesa Ramachandra Rao, Ujjal Kam Gautam and Srinivasa Rao Lingampalli. Application No. PCT/IB2013/059177, filed on 7/10/2013

6. Title of the invention: Antimicrobial Compounds, Their Synthesis and Applications Thereof.
   Inventors: Jayanta Haldar, Chandradhish Ghosh, Gautham Belagula Manjunath and Padma Akkapeddi. Application No. PCT/IB2013/061090, filed on 18/12/2013

7. Title of the invention: Composition, Substrates and Methods Thereof.
   Inventors: Kulkarni Giridhar Udapi Rao, Kunala Durga Mallikarjuna Rao, Ritu Gupta , Boya Radha and Shanmugam Kiruthika. Application No. PCT/IB2014/059411, filed on 4/3/2014

8. Title of the invention: Cd-based-Chalcogenide/CDs Core-Shell Nanomaterial, Defective/Defect-Free Core Nanocrystal, Methods and Applications Thereof.
   Inventors: Ranjani Viswanatha, Kavassery Sureshwaran Narayan, Avijit Saha, and Kishore Velichappattu Chellappan. Application No. PCT/IB2014/059938, filed on 18/3/2014

III. US Patent Applications

1. Title of the invention: Palladium Thiolate Bonding of Carbon Nanotubes.
   Inventors: Kulkarni Giridhar Udapi Rao, Timothy S Fisher, Stephen L Hodson, Baratunde A. Cola and Thiruvelu Bhuvana.US Cont. Application No. 13/938,372, filed on 10/7/2013

2. Title of the invention: Self Assembly of Naphthalene Diimide Derivatives and Process Thereof.
   Inventors: Govindaraju Thimmaiah, Manjula Basavanna Avinash and Makam Pandeeswar. US Application No. 13/980,038, filed on 16/7/2013

3. Title of the invention: Manufacturing Strain Sensitive Sensors and/or Strain Resistant Conduits from a Metal and Carbon Matrix.
   Inventors: Kulkarni Giridhar Udapi Rao, BoyaRadha and Abhay A Sagade. US Application No. 14/124,243, filed on 5/12/2013

4. Title of the invention: Artificial Retina Device (Bulk heterojunction/Electrolyte Polymers as Novel

Biocompatible Photoactive Multi Color-Sensing Technology).
Inventors: Kavassery Sureswaran Narayan, Vini Gautam and Monijit bag. US Application No. 14/235,603, filed on 28/1/2014

IV. Japan, China and South Korean Patent Applications

1. Title of the invention: Manufacturing Strain Sensitive Sensors and/or Strain Resistant Conduits From a Metal and Carbon Matrix
   Inventor: Kulkarni Giridhar Udapi Rao, BoyaRadha and Abhay A Sagade. Japanese Application No. not yet received from Patent office, file on 22/11/2013. Chinese Application No. 201280026128.40, filed on 28/11/2013. South Korean Application No. 10-2013-7032611, filed on 9/12/2013

Patents Granted

1. Title of the invention: Palladium Thiolate Bonding Of Carbon Nanotubes.
   Inventors: Kulkarni Giridhar Udapi Rao, Timothy S Fisher, Stephen L Hodson, Baratunde A. Cola and Thiruvelu Bhuvana. USA Patent No. 8541058 B2, Granted on 24/9/2013
2. Title of the invention: A Novel Process for Micropattern Generation on Polymer Thin Films Using Pulsed Laser Diffraction.
   Inventors: Kulkarni Giridhar Udapi Rao, Ashutosh Sharma (IITK) and Ankur Verma (IITK). USA Patent No. 8545945, Granted on 1/10/2013
3. Title of the invention: Formation of Palladium Sulfide
   Inventors: Kulkarni Giridhar Udapi Rao and Boya Radha. USA Patent No: 8563092, Granted on 22/10/2013
4. Title of the invention: Methods and Compositions for the Separation of Single-Walled Carbon Nanotubes.
   Inventors: Chintamani Nagesa Ramachandra Rao, Subi Jacob George, K Venkata Rao and Rakesh Voggu. US Divisional Patent No. 8580223B2, Granted on 12/11/2013
5. Title of the invention: Julolidine Conjugates and Methods for Their Preparation and Use.
   Inventors: Govindaraju Thimmaiah, Debabrata Maity, Swapan Kumar Pati, Tapas Kumar Kundu, Arun Kumar Manna and Karthigeyan Dhanasekaran.. USA Patent No. 8642764, Granted on 24/2/2014
6. Title of the invention: Optimal Wing Planforms for Reducing the Induced or Total Drag of the Wing of an Aircraft Driven by Wing-Mounted Tractor Propellers/Rotors.
   Inventors: Roddam Narasimha, Madhusudan Deshpande, Praveen Chandrashekarappa and Rakshith Belur Raghavan. Korean Patent No: 10-1308348, Granted on 6/9/2013
7. Title of the invention: A High Sensitivity Assay for Molecular Typing of Biological Sample, Probes and a Kit Thereof.
   Inventors: Ranga Udaykumar, Chandrabhas Narayana and Jayasuryan Narayana. European Patent: Received intimation (4/2/2014) regarding intension of granting patent.

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. Paleoseismology and Tectonics
22. Aberration corrected transmission electron microscopy
23. Soft materials
24. Physics of soft matter
25. Organic materials and organocatalysis
26. Physics and chemistry of nanomaterials
27. Functional organic and supramolecular materials
28. Organic synthesis, molecular probes, peptide and protein chemistry, nucleic acid chemistry, bionanotechnology
29. Bio-organic and medicinal chemistry
30. Designing new ways to small molecule heterocyclic scaffolds
31. Inorganic and solid state chemistry
32. Nanomaterials and renewable energy
33. Solid state inorganic chemistry

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

Research Facilities

(List of equipments procured during 2013-14)

1. GATAN Multiscan 794
2. DV Elite Imaging system
3. Air jacketed $C0_2$ incubator etc
4. Maskless Lithography system
5. UV VIS NIR TRIR and LS55 spectrofluorimeter
6. Innova 4r and Innova 42R refregerated incubator shaker
7. 1500 deg.C horizontal tube furnace
8. Planetary Micro mill pulversette with accessories
9. Electrochemical workstation and optional accessories
10. SQM 160 thin film deposition monitor system with accessories
11. Multielectrode amplifier with data acquisition hardware and software Multiclamp700B
12. Slicescope PRO6000 with one control cube and one patchpad
13. PG welder premium, parallel gap welding system
14. Electrochemical work station CHI608E
15. Genetic analysis system HiSeq - Miseq combine
16. Upgradation of networking and security system on the campus
17. Leica VT 1200S microscope
18. Anti vibration table for slicescope system
19. Olympus inverted trinocular microscope
20. Revelrise X2 Flash chromatograph system
21. Dam2 Drosophila activity monitors, LC4 light controller, VMP vortex, Power supply
22. AMD Servers
23. ESECO speedmatic revolving dark room

SPONSORED RESEARCH PROJECTS (Ongoing)

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
1	J.C. Bose Fellowship	Amitabh Joshi	SERB	5 years
2	Studies on the physiological basis of maternal effects due rearing density in Drosophila melanogaster	B M Prakash	DST	3 years
3	MoU between SHELL and JNCASR entitles: "To develop and validate a predictive method for modelling physical properties of hydrocarbons"	Balasubramanian S.	SHELL	2 years
4	Theoretical Studeis of molecular imprinted polymers for the detection of explosives and toxic gases	Balasubramanian S.	NMRL-DRDC	3 years
5	Thematic Unit of Excellence on "Computational Materials Science" at JNCASR	Balasubramanian S.	DST	5 years
6	Collaborative projects between JNCASR/ICMS & DST	C.N.R. Rao	DST	-
7	Collaboratitve Programme between DRDO and JNCASR	C.N.R. Rao	DRDO	5 years
8	CSIR Centre of Excellence in Chemistry at JNCASR	C.N.R. Rao	CSIR	5 years
9	Swedish Research Links Programme: "Multiplexed immune and DNA-based diagnosis of tuberculosis"	Chandrabhas Narayana	SRL	3 years
10	MoU between JNCASR & Raja Ramanna Centre for Advanced Technology on " High Pressure XRD Measurement System"	Chandrabhas Narayana	RRCAT	1 year
11	JNC-Brucker Sophisticated X-ray diffraction facilities	Co-ordinated by JNCASR	BRUKER, AXS	-
12	Post doctoral fellowship in Nano-Science and Technology	Co-ordinated by JNCASR	DST	Cont.
13	Unit on Nano-Science & Technology-UNANST - DST	Co-ordinated by JNCASR	DST	-
14	Vision Group on Science & Technology, Govt. of Karnataka	Co-ordinated by JNCASR	VGST	-
15	Thematic Unit of Excellence on Nanochemistry at JNCASR	G.U. Kulkarni	DST	5 years

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
16	Development and evaluation of active polymer nanocomposite packaging materials for food contact applications	G.U. Kulkarni	DFRL	1 year
17	ICPC NanoNet Coordination and support action	G.U. Kulkarni	ICPCNN	Cont.
18	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)	G.U. Kulkarni	DST	3 years
19	Indo-US joint networked R&D centre on "Nanomaterials for Energy"	G.U. Kulkarni & Timothy S. Fisher, BNC, Purdue University, USA	IUSSTF	Cont.
20	INSA Senior Scientist	H. Ila	INSA	5 years
21	Synthetic Investigation Heterocyclic scaffolds	H. Ila	CSIR	3 years
22	Examination of the metabolic fate of fumarate a TCA cycle intermediate in Plasmodium falciparum	Hemalatha Balaram	DST	3 years
23	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	Hemalatha Balaram	DST	3 years
24	Plasflsyn Structure/Function studies of plasmodium falciparum GMP synthetase	Hemalatha Balaram	DBT	3 years
25	Ramanujan Fellowship	Jayanta Haldar	DST	5 years
26	Estimating the lift in flapping flight for the design of Entompter/MAV	K.R. Sreeenivas	ADE	3 years
27	Advancing the Efficiency and Production Potential of Excitonic Solar cells (APEX)	K.S. Narayan	DST	3 years

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
28	DAE-SRC Outstanding Research Investigator Award for R/P "Electronic, optoelectronics and photonic properties in soft matter and device exploration "	K.S. Narayan	DAE	5 years
29	Ramanujan Fellowship	Kanishka Biswas	SERB	5 years
30	Structure-function analysis of centromeres of a pathogenic budding yeast candida tropicali	Kaustav Sanyal	DBT	3 years
31	Identification of DNA replication origins and origin binding proteins of the human pathogen, Candida albicans	Kaustuv Sanyal	DBT	3 years
32	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	Kaustuv Sanyal	CSIR	3 years
33	MoU between JNCASR and NCI (Nippon Chemical Industrial Co. Ltd.) on project "Develop inorganic nanomaterials for drug release"	M Eswaramoorthy	NCI	-
34	J.C. Bose Fellowship	M.R.S. Rao	DST, JCB	5 years
35	Reprogramming somatic cells to model cardiovascular differentiation for research and therapeutic potential	Maneesha Inamdar	DBT	3 years
36	Analysis of factors regulating self renewal and differentiation to aid generation of lineage restricted stem cells/progenitors for cell replacement therapy	Maneesha S. Inamdar & Hemalatha Balaram	DBT	3 years
37	Analysis of conserved pathways involved in maintaining homeostasis and survival in mammals and Drosophila	Maneesha S. Inamdar	WT	3 years
38	DAE-SRCH Outstanding Research Investigator Award for the project titled "Dynamics and patterns in granular fluid: Theory and experiment"	Meheboob Alam	DAE	3 years

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
39	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"	Meheboob Alam	BARC	3 years 5 months
40	Understanding pathogenesis of Malaria and strategies to treat it	Namita Surolia	DBT	3 years
41	Delineating viral determinants of HAD using SCID mice	Ranga Udaykumar	AECOM	Cont.
42	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"	Ranga Udaykumar	DST	3 years
43	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	Ranga Udaykumar	DST	5 years
44	Evaluation of host immune responses to the Tat antigen of HIV-1 in the Indian clinical cohorts	Ranga Udaykumar, Co-PI: Suniti Solomon, Director, YRGC for AIDS, Res. And Edun., Chennai	DBT	3 years
45	Indo-Finland collaboration on biotechnology titled: "Innovative concept for infectious disease diagnostics"	Ranga Udaykumar, JNCASR & Swaminathan, RGP Lab. ICGEB, New Delhi	DBT	2 years
46	Mechanisms of Chikungunya virus disease: mouse model, virulent and fitness determinants and the development of novel therapeutics	Ranga Udaykumar, JNCASR, Co-PI: Shobha Broor Dept. of Microbiology AIIMS, New Delhi	DBT	3 years
47	Pulsed Laser Desposition (PLD) growth of ZnO BCN and study their properties from atomic scale imaging and spectroscopic techniques	Ranjan Datta	SERB	3 years

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
48	Welcome Trust - DBT India Alliance award to Ravi Manjithay a an Intermediate Fellowship entitles: Small molecule modulators of autophagy and autophagy related pathways	Ravi Manjithaya	WT-DBT	5 years
49	Mou between JNCASR & HPCL "Development of Microbial catalysts (Biocatalysts) for Fermentative Butanol Production	Ravi Manjithayya	HPCL	2 years
50	Ramanujan Fellowship	Rema Krishnaswamy	DST	5 years
51	Numerical Simulation of cloud flow and mixing layers	Roddam Narasimha	INTEL	1 year
52	DNS of Turbo-Machinery Blading	Roddam Narasimha	GTRE	2 years
53	Aerodynamic shape optimization	S.M. Deshpande	INTEL	1 year
54	Development of Meshless Solver, Point Clouds and preprocessor in Computational Fluid Dynamics (CFD)	S.M. Deshpande	NAL	3 years
55	Grid-based libraries	Santosh Ansumali	INTEL	1 year
56	Ramanujan Fellowship	Santosh Ansumali	DST	5 years
57	Ramanujan Fellowship	Sebastian C Peter	DST	5 years
58	Rare earth doped chalcogenide glasses for optical and photonic applications	Sebastian C Peter	SERB	3 years
59	Structure-property relations in RE2TGe3 (RE=rare earths; T=transition metals) compounds" (CRS-M-166)	Sebastian C Peter	UGC	3 year
60	Ramanujan Fellowship	Subir Kumar Das	DST	5 years
61	Numerical Investigations of Unsteady aerodynamics in insect Flight	Sunderesan A	ADE	3 years
62	Indo-Italian Project entitled: From Small Molecules to Advanced Molecular Materials:Transport and Transfer Properties	Swapan K. Pati	DST	3 years
63	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"	Swapan K. Pati	AOARD	2 years

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
64	Indo-US joint Research Centre of Excellence in "Advanced Materials Research"	Swapan K. Pati & Vinayak P. Dravid, North-western Univ., IL, USA	IUSSTF	3 years
65	Innovative Young Biotechnologists Award to T. Govidaraju entitles: "Development of Biomimetic Materials as substitutes for Natural Fibers using Designed Modular Peptides"	T. Govindaraju	DBT	3 years
66	J.C. Bose Fellowship	Tapas Kumar Kundu	DST	5 years
67	Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory	Tapas Kumar Kundu	IFCPAR	3 years
68	Regulation of Chromatin Associated proteins by miRN As: Implications in Breast Cancer	Tapas Kumar Kundu	DBT	3 years
69	Targeting protein lysine acetylation in oral cancer and neurodegenerative disorders using nanomaterials	Tapas Kumar Kundu & Eswaramoorthy M	DBT	3 years
70	Programme support on chromatin and disease (Chromatin dynamics and transcription regulations: Implications in disease and therapeutics)	Tapas Kumar Kundu Co-PI: Ranga Udaykumar	DBT	5 years
71	Ramanujan Fellowship	Ujjal K. Gautam	DST	5 years
72	Alloy development and mechanical behaviour	Umesh V. Waghmare	GEGR	2 years
73	First-principles determination of thermal properties in nano-structured hexagonal solids with doping modifications for thermal energy harvesting	Umesh V. Waghmare	AOARD	1 year
74	IBM Faculty Award 2009	Umesh V. Waghmare	IBM	Cont.
75	DAE-SRC Outstanding Research Investigator Award for R/ P Multi scale modeling and simulations of functional Materials	Umesh V. Waghmare	DAE	5 years
76	Density functional theory calculations	Umesh V. Waghmare	P&G	1 year

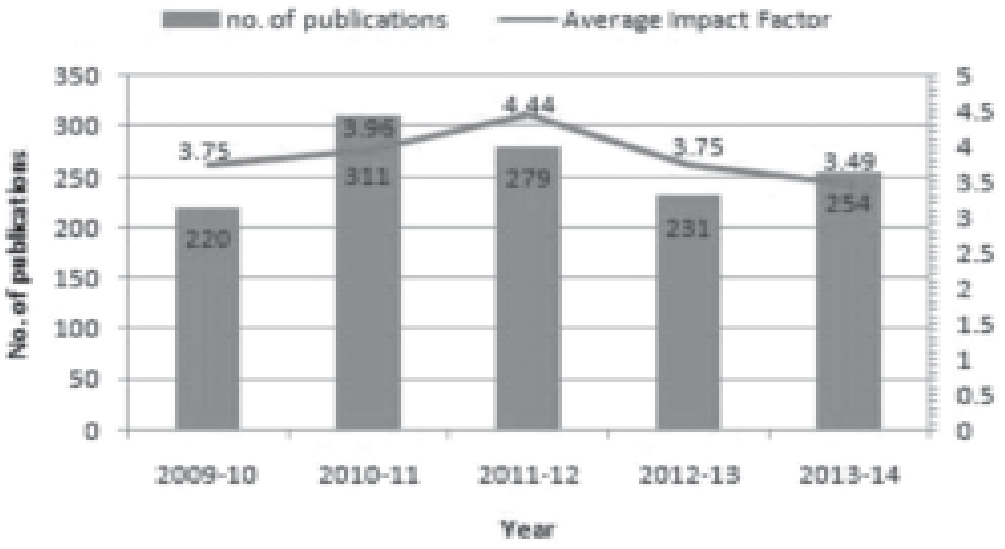
NEW SPONSORED RESEARCH PROJECTS
(Started during 2013-14)

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
1	Congential Deafness in Dhadkai village of Doa district of Jammu & kashmir	Anurajan Anand	ICMR	2 Years
2	Evaluating earthquake/tsunami recurrence along the Andaman are from the study of shallow cores	C. P. Rajendran	DST	3 years
3	Indo - Australian workshop on Smart functional nanomaterials @ Melbourne	G. U. Kulkarni	Indo-Australian	
4	Identification of centromeres of the budding yeast Saccharomyces Castellii	Kaustuv Sanyal	DBT	3 years
5	Role of histone H3 variants in genome indexing in Candida albicans	Kaustuv Sanyal	SERB	3 years
6	Characterisation of the fungal specific Dam-1 complex as an attractive target for safer and more potent anti fungal drug to treat candidiasis	Kaustuv Sanyal, Co-PI: Anuranjan Anand	DBT	3 years
7	Indo - Denmark collaboration on health & science biotechnology titled "Genetics towards future cell therapy in Diabetes & Cardiovascular Disease understanding Embryonic Stem Cell Pluripotency & Differentiation towards a renewable resource of Parcreatic Beta Cells & Cardiomyocytes"	Maneesha S Inamdar	DBT	3 years
8	Analysis of in vivo transcription of plasmodium falciparum from Indian patents suffering from cerebral malaria and its comparision with that from patents infected with severe maleria (with MOD) symptoms	Namita Surolia	ICMR	3 years

Sl. No.	Project	Project Investigator (s)	Funding Agency	Duration
9	Synthesis & study of the optical magnetic & electrical properties of co-doped II-IV semiconductor nanocrystals	Ranjani Viswanatha	DST	3 years
10	The year of science	Roddam Narasimha	DST	5 years
11	A study of the interactions between the circadian clock & homeostatic mechanisms regulating sleep & arousal in Drosophila melanogaster	Sheeba Vasu	SERB	3 years
12	Computational modeling on fuels cells for clean and efficient energy storage	Siamkhanthang Neihsial	SERB	3 years
13	J C Bose Fellowship	Swapan K Pati	DST-JCB	5 years
14	Nano 2 Fun	Swapan K Pati & Subi Jacob George	EU	
15	Developing novel chemosensors of metal ions in aqueous media for environmental & biological applications	T Govindaraju	CSIR	3 years
16	India - Japan project entitled : Mechanism of Chromatin Repair, role of chromatin Associated Protein PC4 Acetylation by Tip60	Tapas Kumar Kundu	DST	2 Years
17	Between - group encounters and its correlates in female asian elephants	TNC Vidya	CSIR	2 years
18	Between - Group encounters & its correlates in female Asian Elephants	TNC Vidya	NGS	2 years
19	J. C. Bose Fellowship	Umesh V Waghmare	DST	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:



Chemistry and Physics of Materials Unit

1. Das, A. J.; Narayan, K. S., Retention of Power Conversion Efficiency From Small Area to Large Area Polymer Solar Cells. Advanced Materials 2013 (Apr), 25 (15), 2193-2199, http://dx.doi.org/10.1002/adma.201204048

2. Kumar, A. S.; Datta, K. K. R.; Rao, T. S.; Raghavan, K. V.; Eswaramoorthy, M.; Reddy, B. V. S., Aminoclay-Supported Copper Nanoparticles for 1,3-Dipolar Cycloaddition of Azides with Alkynes via Click Chemistry. Journal of Nanoscience and Nanotechnology 2013 (Apr), 13 (4), 3136-3141, http://dx.doi.org/10.1166/jnn.2013.7343

3. Narayan, R.; Kumar, P.; Narayan, K. S.; Asha, S. K., Nanostructured Crystalline Comb Polymer of Perylenebisimide by Directed Self-Assembly: Poly(4-vinylpyridine)-pentadecylphenol Perylenebisimide. Advanced Functional Materials 2013 (Apr), 23 (16), 2033-2043, http://dx.doi.org/10.1002/adfm.201202366

4. Singla, N.; Bhadram, V. S.; Narayana, C.; Chowdhury, P., White Light Generation by Carbonyl Based Indole Derivatives Due to Proton Transfer: An Efficient Fluorescence Sensor. Journal of Physical Chemistry A 2013 (Apr), 117 (13), 2738-2752, http://dx.doi.org/10.1021/jp310331n

5. Menaa, F.; Menaa, B.; Kundu, P. P.; Narayana, C.; Sharts, O. N., Physical Characterization of Blood Substitutes by Carbon-Fluorine Spectroscopy. Pharmaceutica Analytica Acta 2013 (May), 4 (5), 235-1-235-4, http://dx.doi.org/10.4172/2153-2435.1000235

6. Jagadeesan, D.; Sundarayya, Y.; Madras, G.; Rao, C. N. R., Direct conversion of calcium carbonate to C-1-C-3 hydrocarbons. RSC Advances 2013 (May), 3 (20), 7224-7229, http://dx.doi.org/10.1039/c3ra40264a

7. Jayaramulu, K.; Krishna, K. S.; George, S. J.; Eswaramoorthy, M.; Maji, T. K., Shape assisted fabrication of fluorescent cages of squarate based metal- organic coordination frameworks. Chemical Communications 2013 (May), 49 (38), 3937-3939, http://dx.doi.org/10.1039/c3cc39190f

8. Jayaramulu, K.; Kumar, N.; Hazra, A.; Maji, T. K.; Rao, C. N. R., A Nanoporous Borocarbonitride (BC_4N) with Novel Properties Derived from a Boron-Imidazolate-Based MetalOrganic Framework.

Chemistry-a European Journal 2013 (May), 19 (22), 6966-6970, http://dx.doi.org/10.1002/chem.201300054

9. Kumar, N.; Moses, K.; Pramoda, K.; Shirodkar, S. N.; Mishra, A. K.; Waghmare, U. V.; Sundaresan, A.; Rao, C. N. R., Borocarbonitrides, BxCyNz. Journal of Materials Chemistry A 2013 (May), 1 (19), 5806-5821, http://dx.doi.org/10.1039/c3ta01345f

10. Kumar, R.; Jayaramulu, K.; Maji, T. K.; Rao, C. N. R., Hybrid nanocomposites of ZIF-8 with graphene oxide exhibiting tunable morphology, significant CO_2 uptake and other novel properties. Chemical Communications 2013 (May), 49 (43), 4947-4949, http://dx.doi.org/10.1039/c3cc00136a

11. Mettela, G.; Boya, R.; Singh, D.; Kumar, G. V. P.; Kulkarni, G. U., Highly tapered pentagonal bipyramidal Au microcrystals with high index faceted corrugation: Synthesis and optical properties. Scientific Reports 2013 (May), 3, 1793 http://dx.doi.org/10.1038/srep01793

12. Mohapatra, S.; Rajeswaran, B.; Chakraborty, A.; Sundaresan, A.; Maji, T. K., Bimodal Magneto-Luminescent Dysprosium (Dy-III)-Potassium (K-I)-Oxalate Framework: Magnetic Switchability with High Anisotropic Barrier and Solvent Sensing. Chemistry of Materials 2013 (May), 25 (9), 1673-1679, http://dx.doi.org/10.1021/cm400116h

13. Rao, B. G.; Matte, H.; Chaturbedy, P.; Rao, C. N. R., Hydrodesulfurization of Thiophene over Few-Layer MoS_2 Covered with Cobalt and Nickel Nanoparticles. Chempluschem 2013 (May), 78 (5), 419-422, http://dx.doi.org/10.1002/cplu.201300012

14. Shipra, R.; Kumar, N.; Sundaresan, A., Surface ferromagnetism and superconducting properties of nanocrystalline niobium nitride. Materials Chemistry and Physics 2013 (May), 139 (2-3), 500-505, http://dx.doi.org/10.1016/j.matchemphys.2013.01.048

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Book Chapter

1. S.Chandrasekaran; V.Ganesh., Oxidation Adjacent to Oxygen of Alcohols by Chromium Reagents. In ***Comprehensive Organic Synthesis II (Second Edition)***, Knochel; P.; Molander, G. A., Eds. Science Direct: 2014; Vol. 7, pp 277-294.

AWARDS / DISTINCTIONS

Prof. C.N.R. Rao

The Bharat Ratna, the highest civilian award of Government of India,

Chosen as one of the 25 Greatest Global Living Legends by NDTV

Honorary D.Sc. from the University of St. Andrews, U.K.

Prof. Roddam Narasimha

Life Time Excellence Award in the sphere of Earth System Sciences – 2013. The Earth System Science Organization, Ministry of Earth Sciences.

IETE Diamond Jubilee Medal awarded by the Institution of Electronics and Telecommunication Engineers, New Delhi

Prof. Tapas Kumar Kundu

Journal of Biochemistry (JB) Prize for 2013 instituted by The Japanese Biochemical Society.

Prof. Umesh V. Waghmare

Adjunct Professor at the Tata Institute of Fundamental Research (TIFR)

2nd Young Career Award in Nano Science & Tech-2014

Prof. Swapan K Pati

TWAS (The World Academy of Science) Prize in Chemistry (shared) in September 2013.

Prof. Shobhana Narasimhan

Named one of "India's most Inspiring Women Engineers and Scientists" by Engineering Watch

Prof. Meheboob Alam

APS Outstanding Referee Award (2014) from American Physical Society's Physical Review and Physical Review Letters journals

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

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

Prof. Tapas Kumar Maji

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

MRSI (Materials Research Society of India) Medal for 2014.

Dr. Subi J George

Emerging Investigator by Journal of Materials Chemistry (2014)

Mr. V.R. Sathyendranath

Most Valuable Staff Member – 2013.

AWARDS/RECOGNITION RECEIVED BY HONORARY FACULTY MEMBERS

Prof. A.K.Sood

Foundation day lecture of Shriram Institute, New Delhi.

Indian Science Congress Award for outstanding contributions to Science (2014)

Prof. Umesh Varshney

Sir Walter Murdoch Distinguished Collaborator Award, Murdoch University, Australia (2013).

Ranbaxy Research Awards, 2012 in the field of Medical Sciences- Basic Research (Ranbaxy Science Foundation, India).

Prof. Partha P. Majumder

Centenary Medal for Excellence, 2014: School of Tropical Medicine, Kolkata

Prof. S. Chandrasekaran

Awarded the Science and Engineering Research Board (SERB) Distinguished Fellowship

Prof. Nagaraja V.

Fellowship of The World Academy of Sciences (TWAS)-2013

Member of Karnataka Innovation Council (2014).

Prof. Raghavendra Gadagkar

Member, Council of Scientific & Industrial Research Society, April 2013 – March 2016.

Chairman, Advisory Board, 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.

Honorary Professor, Indian Institute of Science Education & Research (IISER), Mohali, August 2013 – present.

President, Indian National Science Academy, New Delhi January 2014 - 2016

AWARDS RECEIVED BY STUDENTS

Mr. M. B. Avinash's (Ph.D. student, New Chemistry Unit) work on "Self-cleaning functional molecular material" has been appreciated with "Gandhian Young Technological Innovation Award" under "SRISTI Technological Edge/Strategic Innovation" category at Indian Institute of Management - Ahmedabad (IIM-A).

Mr. Ankit Jain (PhD student; Research supervisor: Dr. Subi George) was awarded best poster prize in the 3rd Federation of Asian Polymer Societies Conference and MACRO- 2013 held during May 15-18, 2013.

Mr. Soumik Sidhantha (PhD student; Research supervisor: Prof. Chandrabhas Narayana) won the best poster award in the International Conference on Materials for Advanced Technology (ICMAT) held in Singapore, in the category of *Nanostructures for Bio Sensing and Detection*. ICMAT is conducted by Materials Research Society (MRS), Singapore every year. This year it was held in Suntec Singapore from June 30 to July 5, 2013.

Mr. M. Pandeeswar (Student, Bioorganic Chemistry Laboratory, New Chemistry Unit) bags "Best Poster Award" at "Indo-US Symposium" on "Molecular Materials" held at Indian Institute of Science (IISc), Bangalore, India during July 15-17, 2013.

Mr. B V V S Prasanna Kumar and Mr. Rana Saha received Sheik Saqr RAK CAM Fellowship 2014.

Ms. Bhawani N (PhD student, NCU; Research supervisor: Dr. Subi J. George) was awarded best poster prize in the 16th CRSI National Symposium in Chemistry at IIT Bombay held during February 7-9, 2014.

Mr. Mohit Kumar (PhD student, NCU; Research supervisor: Dr. Subi J. George) was awarded the best poster prize in the Indo-US conference on 'Bio-inspired Supramolecular and Polymer Assemblies' held at Trivandrum, during December 15-17, 2013.

FELLOWSHIPS

Prof. M.R.S. Rao
SERB Distinguished Fellow

Prof. K.B. Sinha
SERB Distinguished Fellow

Prof. G.U. Kulkarni

Fellow of the National Academy of Sciences, Allahabad
Fellow of the Indian Academy of Sciences, Bangalore

Prof. S. Balasubramanian
Sheikh Saqr RAK CAM Senior Fellowship

Prof. Anuranjan Anand
Fellow of National Academy of Sciences, Allahabad

Prof. Umesh V. Waghmare
J.C. Bose National Fellowship

Prof. Swapan K Pati
J.C. Bose National Fellowship (September 2013 – August 2018)

Dr. T Govindaraju

Sheikh Saqr Career Award Fellow (2014)

Dr. Subi J George
Sheikh Saqr Career Award Fellow (2014)

Dr. Ranjani Viswanatha
Associate of Indian Academy of Sciences (2013 – 2016)

MEMBERSHIPS / APPOINTMENTS

Prof. C.N.R. Rao
Elected as Honorary Foreign Member of the Chinese Academy of Sciences

Dr. N. S. Vidhyadhiraja
Appointed adjunct faculty at Department of Physics and Astronomy, Louisiana State University

EDITORIAL BOARDS

Dr. Jayanta Haldar
Editorial Board Member of the Journal "Microbial Pathogenesis" published by Elsevier

Dr. Kanishka Biswas
Editorial Board Member of the Journal "Materials Science in Semiconductor Processing" *published by Elsevier*

FINANCIAL STATEMENTS

Name	**:**	**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**
Address	**:**	**JAKKUR POST, BANGALORE – 560 064**
Year Ended	**:**	**31st MARCH 2014**
Assessment Year	**:**	**2014-15**

G.R. VENKATANARAYANA
CHARTERED ACCOUNTANTS
Partners :
CA. G.R. Venkatanarayana, B.Com., F.C.A.,
CA. G.S. Umesh, B.Com., F.C.A.,
CA. Venugopal N. Hegde, B.Com., A.C.A.,

No. 618, 75th Cross, 6th Block
Rajajinagar, Bangalore-560 010.
Ph: 23404921 / 64637325
Fax: 23500525
Email: grvauditor@gmail.com
1grvenkat@gmail.com

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

We have audited the attached Balance Sheet of **Jawaharlal Nehru Centre For Advanced Scientific Research** as at March 31, 2014 and also the Income & Expenditure Account for the year ended on that date and the Receipts and Payment account for the year ended on that date annexed thereto.

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, 2014 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:

(i) 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]

(ii) 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 M/s G R Venkatanarayana
Chartered Accountants

(G R Venkatanarayana)
Partner
Membership No. 018067
Firm Regn. No. 004616S

M/s. G.R. VENKATANARAYANA
Chartered Accountants
[illegible] 6th Block
[illegible] 530 010

Place : Bangalore
Date: 22.09.2014

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
BALANCE SHEET AS AT 31ST MARCH 2014

Description	Schedule	Current year 2013-14 Rs. Ps.	Previous year 2012-13 Rs. Ps.
LIABILITIES			
Corpus/Capital Fund	1	**2,171,760,759.32**	1,948,737,679.32
Reserves & Surpluses	2	**(55,521,186.07)**	(22,611,981.80)
Earmarked and Endowment Funds	3	**274,209,045.83**	253,237,801.82
Secured loans and Borrowings	4	**0.00**	0.00
Unsecured loans and Borrowings	5	**0.00**	0.00
Deferred Credit Liabilities	6	**0.00**	0.00
Current Liabilities and Provisions	7	**27,899,880.37**	38,401,186.43
Other funds-Cluster Studies		**39,541.00**	39,541.00
Scheme Balances		**136,541,685.46**	235,334,009.46
Total		**2,554,929,725.91**	2,453,138,236.23
ASSETS			
Fixed Assets (gross)	8	**2,171,760,759.32**	1,948,737,679.32
Investments-Endowment Funds	9	**271,166,737.00**	247,984,117.00
Investment - Others	10	**0.00**	0.00
Current Assets, Loans, Advances etc.	11	**112,002,229.59**	256,416,439.91
Total		**2,554,929,725.91**	2,453,138,236.23
Significant accounting policies	24		
Contingent Liabilities & Notes on Accounts	25		

Schedule 1 to 25 form integral part of Accounts

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

for **G.R. VENKATANARAYANA & Co.,**
Chartered Accountants
Sd/-
(G.R. VENKATANARAYANA)
Partner
Member ship No. 018067
Place : Bangalore Date : 22.09.2014

For Jawaharlal Nehru for Advanced Scientific Research

Sd/-
Prof. K.S. Narayan
President In Charge

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2014

Description	Schedule	Current year 2013-14 Rs. Ps.	Previous year 2012-13 Rs. Ps.
Income			
Income from services	12	**0.00**	0.00
Grants/Subsidies received	13	**562,408,000.00**	512,800,000.00
		562,408,000.00	512,800,000.00
Less: Extent of fixed assests procured		**223,023,080.00**	200,733,882.00
		339,384,920.00	312,066,118.00
Add:Proceeds of sale of fixed assets		**0.00**	75,000.00
		339,384,920.00	312,141,118.00
Income from Fees/Subscriptions etc	14	**1,622,426.00**	1,582,050.00
Income from investments	15	**0.00**	0.00
Royalty Income,Publication,Licence fee etc	16	**1,639,628.34**	2,985,697.05
Interest earned	17	**16,876,977.00**	7,207,828.00
Other income	18	**31,620,679.00**	44,389,619.21
Increase/decrease in stocks	19	**0.00**	0.00
Total		**391,144,630.34**	**368,306,312.26**
Expenditure			
Establishment expenses	20	**218,417,024.00**	202,993,769.00
Other administrative expenses	21	**205,601,337.73**	203,522,861.25
Expenditure on Grants,Subsidies etc	22	**0.00**	0.00
Interest & bank charges	23	**35,472.88**	154,192.00
Total		**424,053,834.61**	**406,670,822.25**
Excess of Expenditure over income		**(32,909,204.27)**	(38,364,509.99)
Balance brought forward		**(22,611,981.80)**	36,041,572.19
		(55,521,186.07)	(2,322,937.80)
Transferred to Corpus Fund Account		**0.00**	(20,289,044.00)
Balance carried to Balance sheet		**(55,521,186.07)**	**(22,611,981.80)**
Significant accounting policies (Enclosed)	24		
Contingent Liabilities & Notes on Accounts	25		

Schedule 1 to 25 form integral part of Accounts

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

for **G.R. VENKATANARAYANA & Co.,**
Chartered Accountants
Sd/-
(G.R. VENKATANARAYANA)
Partner
Member ship No. 018067
Place : Bangalore Date : 22.09.2014

For Jawaharlal Nehru for Advanced Scientific Research

Sd/-
Prof. K.S. Narayan
President In Charge

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
CPF & NPS FUND STATEMENT OF AFFAIRS FOR THE YEAR ENDED ON 31.03.2014

Particulars	Rs. Ps.	Rs. Ps.	Particulars	Rs. Ps.	Rs. Ps.
CONTRIBUTORY PROVIDENT FUND			**INVESTMENT OF FUNDS :**		
SUBSCRIPTION :			**Investments in :**		
Opening Balance		47,029,067.00	Government of India 8 % Bonds (SHCIL)	18,500,000.00	
Add : Subscriptions received during the year	6,584,145.00				
Loan repayments	3,119,309.00		Fixed Deposits at Canara Bank	19,100,000.00	
Interest on subscriptions	4,100,433.00	13,803,887.00	Fixed Deposit at HDFC	42,500,000.00	80,100,000.00
		60,832,954.00			
Less: Loans granted during the year	3,717,795.00		Closing Cash and Bank Balance :		
Less: Withdrawals on retirement/death	1,654,208.00	5,372,003.00	**Cash at Bank :**		
Closing Balance		55,460,951.00	SB A/C No.17513		
			Canara Bank,IISc branch	7,978,369.87	
CONTRIBUTION					
Opening balance		35,279,377.00	Cheque related to March 2014		
Add : Contribution during the year	2,868,013.00		accounted in 01.04.2014		
Interest on total contributions	2,854,696.00	5,722,709.00	Add :Cheque no.246948	224,595.00	
		41,002,086.00	Add :Cheque no.246948	735,884.00	
Less: payments during the year	1,135,703.00	1,135,703.00		960,479.00	
Closing Balance		39,866,383.00	Less : Cheque issued to Mr.Jayaramaiah	-901,655.00	
NEW PENSION SCHEME			Net Closing balance at Bank	58,824.00	8,037,193.87
SUBSCRIPTION					
Opening Balance		246,984.00	TDS GOI Bonds (2013-14) receivable		148,000.00
			TDS-GOI Bonds (previous years) receivable		734,492.00
Total		246,984.00			
Less : Transfer to NSDL on A/c of NPS		166,433.00	Due to be remitted to bank on account		
Closing Balance		80,551.00	of short payment during 2007 08		179.00
CONTRIBUTION			**Accrued interest on Deposits :**		5,681,199.00
Opening balance		219,430.00			
Total		219,430.00			
Less : Transfer to NSDL on A/c of NPS		144,948.00			
Closing Balance		74,482.00			
			Balance Deficit		**781303.13**
Total		**95,482,367.00**	**Total**		**95,482,367.00**

for **G.R. VENKATANARAYANA & Co.,**
Chartered Accountants

Sd/-
(G.R. VENKATANARAYANA)
Partner
Membership No. 018067
Place: Bangalore, Dated:22.09.2014

for **Jawaharlal Nehru Centre for Advanced Scientific Research**

Prof. K.S. Narayan
President In Charge

R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31.03.2014

OPENING BALANCES & RECEIPTS	2013-14 Rs Ps	2012-13 Rs Ps	PAYMENTS & CLOSING BALANCES	2013-14 Rs Ps	2012-13 Rs Ps
I. Opening Balances:			**I. Expenses;**		
a. Cash in hand & Imprest at centre	68,826.00	221,661.00	a. Establishment Expenses	216,500,037.00	202,993,769.00
			b. Administrative Expenses	196,312,438.73	203,522,861.25
b. Bank balances:			c. Expenditure of Endowments	4,057,998.00	2,470,822.00
In savings bank Accounts:				**416,870,473.73**	**408,987,452.25**
Canara bank	8,615,603.05	7,270,018.65	**II. Payment made against funds**		
Union Bank of India	168,304.00	161,751.00	**for various projects:**	0.00	0.00
SBI	1,729,686.00	80,901.00			
In Deposit accounts:			**III. Investments and Deposits made:**	0.00	0.00
At HDFC Trust	80,705,500.00	47,005,500.00	**IV. Expenditure on Fixed assets and**		
At SBI 61,500,000.00			**Capital Work-in-progress:**		
At Canara Bank	103,908,000.00	217,408,000.00	a. Purchase of fixed assets	**219,009,602.00**	**200,733,882.00**
	256,695,919.05	**272,147,831.65**			
II. Grants Received:			**V. Refund of surplus money/Loans**	0.00	0.00
From DST-Grant in aid	550,000,000.00	490,200,000.00	**VI. Finance charges(Bank charges)**	**35,472.88**	**154,192.00**
From Govt agencies	10,008,000.00	16,600,000.00			
From other agencies	2,400,000.00	6,000,000.00			
On behalf of Endowments	0.00	2,366,370.00			
	562,408,000.00	**515,166,370.00**			
III. Income on Investments :					
A. Interest on FD's:					
a. From Earmarked/Endowment Funds	16,484,044.00	14,184,564.00			
b. From Own funds	14,179,240.00	4,499,757.00			
	30,663,284.00	**18,684,321.00**			
IV. Interest received:					
a. On Bank S.B A/c	2,697,737.00	2,708,071.00			
Balance Carried forward	**852,464,940.05**	**808,706,593.65**	**Balance Carried forward**	**635,915,548.61**	**609,875,526.25**

(Contd…)

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31.03.2014 Contd…)

OPENING BALANCES & RECEIPTS	2013-14 Rs Ps	2012-13 Rs Ps	PAYMENTS & CLOSING BALANCES	2013-14 Rs Ps	2012-13 Rs Ps
Balance Brought Forward	**852,464,940.05**	**808,706,593.65**	**Balance Brought Forward**	**635,915,548.61**	**609,875,526.25**
V. Other Income:			**VII. Other payments:**		
a. Royalty	1,058,893.34	2,904,764.05	Earnest money deposit returned	459,500.00	0.00
b. Licence Fee	0.00	80,933.00	Staff advances (Festival adv etc.)	720,000.00	0.00
			refund to projects	75,007,829.00	
			Other advances	27,291,912.65	
c. Collections from Visitors,Guest	2,292,926.00		Security deposit returned	1,904,032.00	0.00
room etc		4,082,132.00	TDS on interest	0.00	1,558,263.00
			Advances with faculty	3,844,645.00	0.00
d. From fee,subscription etc	703,637.00	1,582,050.00	Payment to sundry creditors	1,661,662.00	0.00
e. CSIR fellowships,UGC, DBT					
reimbursements	18,332,811.00	23,561,441.00		**110,889,580.65**	**1,558,263.00**
f. Overhead recoveries	8,000,000.00	16,000,000.00			
g. From services	0.00	0.00			
h. From others	667,349.00	746,046.21	**VIII. Closing Balances:**		
	31,055,616.34	**48,957,366.26**	a. Cash in hand & Imprest at centre	134,088.00	68,826.00
			b. Bank balances:		
VI. Amount received from projects	**37,500,000.00**	**0.00**	**In savings bank accounts at:**		
			Canara Bank	3,000,144.13	8,615,603.05
VII. Other receipts:			Union Bank of India	175,103.00	168,304.00
From disposal of fixed assets	0.00	75,000.00	State Bank Of India	142,881.00	1,729,686.00
Income tax refunds	605600.00	0.00	**In deposit accounts at:**		
From Sundry Creditors	14334846	0.00			
Staff advances recovered	5000	0.00			
Other advances recovered	328689.00	0.00			
Earnest money received	286000.00	8,851,628.39	Canara bank	113,908,000.00	103,908,000.00
Project funding received	75790154.00	1,007,995.00	SHCIL	61,500,000.00	61,500,000.00
Other advances recovered	0.00	11,110.00	At HDFC trust	86,705,500.00	80,705,500.00
Earnest money received	0.00	520,015.00			
	91,350,289.00	**10,465,748.39**		**265,565,716.13**	**256,695,919.05**
TOTAL	**1,012,370,845.39**	**868,129,708.30**	**TOTAL**	**1,012,370,845.39**	**868,129,708.30**

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

for **G.R. VENKATANARAYANA & Co.,**
Chartered Accountants
Sd/-
(G.R. VENKATANARAYANA)
Partner
Membership No. 018067
Place : Bangalore Date : 22.09.2014

For Jawaharlal Nehru Centre for Advanced Scientific Research

Sd/-
Prof. K.S. Narayan
President In Charge

Sd/-
R.S.Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2013-14	2012-13
	Rs. Ps.	Rs. Ps.
SCHEDULE 1- Capital Fund		
Balance as at the beginning of the year	1,948,737,679.32	1,748,078,797.32
	1,948,737,679.32	1,748,078,797.32
Less : Depreciation up to the end of previous year	515,961,018.00	436,659,498.28
	1,432,776,661.32	1,311,419,299.04
Add : Addition to Fixed Assets during current year	223,023,080.00	200,733,882.00
	1,655,799,741.32	1,512,153,181.04
Less : Deletion to Fixed Assets during Current Year	0.00	75,000.00
	1,655,799,741.32	1,512,078,181.04
Less : Depreciation for the current year	88,623,298.00	79,301,520.00
	1,567,176,443.32	1,432,776,661.04
Add : Depreciation Reserve per contra	604,584,316.00	515,961,018.28
Total	**2,171,760,759.32**	**1,948,737,679.32**
SCHEDULE 2- Reserves And Surpluses:		
General Reserve:		
Surplus/deficit In Income and expenditure Account	(55,521,186.07)	(22,611,981.80)
SCHEDULE 3- Earmarked / Endowment Funds:		
A : Infrastructure Corpus Fund		
Opening Balance	188,087,640.64	155,909,088.64
Additions during the year	0.00	20,289,044.00
Funds-Income from Investments made	19,326,396.90	11,889,508.00
Total	**207,414,037.54**	**188,087,640.64**
B : Other funds		
Opening Balance of the Funds	65,150,161.18	62,122,636.18
Add : Additions :		
Funds/Donations/Grants/Royalties	30,000.00	2,366,370.00
Funds-Income from Investments made	5,266,575.11	3,131,977.00
	70,446,736.29	67,620,983.18
Less : Funds-utilisation/Expenditure incurred	3,651,728.00	2,470,822.00
Total	**66,795,008.29**	**65,150,161.18**
Grand Total - Infrastructure Corpus and Other Funds	**274,209,045.83**	**253,237,801.82**
SCHEDULE 4-Secured Loans And Borrowings:	0.00	0.00
SCHEDULE 5-Unsecured Loans And Borrowings:	0.00	0.00
SCHEDULE 6-Deferred Credit Liabilities:	0.00	0.00
SCHEDULE 7- Current liabilities and provisions		
Sundry Creditors EMD	4,686,387.00	1,662,004.00
Sundry Creditors for others	23,213,493.37	36,739,182.43
Total	**27,899,880.37**	**38,401,186.43**

Sd/-
R .S. Gururaj
Accounts Officer

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

Description	2013-14	2012-13
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	87,833,491.26
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 & Mechanical 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
Extention 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 Material Science	48,187,253.00	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
Extention 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 - Administrative Officer	3,659,034.00	3,659,034.00
Child Care Centre	728,827.00	728,827.00
Hostel Phase -IV	25,934,842.00	25,934,842.00
Extention to Biology lab	19,424,005.00	19,424,005.00
SCADA - DG Room	240,660.00	240,660.00
President's Residence	7,788,054.00	7,080,951.00
Visiting Students Hostel	33,982,070.00	32,137,685.00
Health Centre	3,243,422.00	3,243,422.00
Nano Institute Shivanapura	3,709,242.00	3,709,242.00
EOBU Lab block	19,263,812.00	8,540,395.00
Post-Doc Housing-Srirampuram	2,797,966.00	1,300,000.00
Material Science Lab Block	52,323,987.00	29,218,163.00
New Auditorium	4,945,649.00	0.00
Total	**513,939,459.26**	**471,005,485.26**
Infrastructure Facilities:		
Roads,Streetlights,Drianages,partitions etc	91,972,607.32	89,956,110.32
Tubewells and water supply	248,912.00	248,912.00
Total	**92,221,519.32**	**90,205,022.32**
Plant/Machinery/Equipment:		
Scientific Equipments/Plant/Machinery	804,905,531.45	683,904,888.45
ICMS-Laboratory equipments & facilities	203,234,885.00	183,569,588.00
Equipments - Chemistry & Physics of Materials	74,041,456.00	74,041,456.00
Total	**1,082,181,872.45**	**941,515,932.45**
Others :		
Vehicles	2,703,373.00	2,703,373.00
Furniture and fixtures	67,569,794.87	61,286,739.87
Office equipment	20,017,235.41	15,851,946.41
Computer/peripherals	69,780,350.00	67,612,223.00
Electrical installations	112,738,560.00	112,738,560.00
Library Books	28,065,533.21	26,926,539.21
Library Journals	150,179,181.80	133,486,405.80
Total	**451,054,028.29**	**420,605,787.29**
Intangible Assets: Software	14,648,529.00	7,690,101.00
Total	**2,171,760,759.32**	**1,948,737,679.32**
Less -Depreciation up to the end of previous year	515,961,018.00	436,659,498.00
Depreciation for the current year	88,623,298.00	79,301,520.00
Written down value of the assets as at the year end	1,567,176,443.32	1,432,776,661.32
Add - depreciation reserve per contra	604,584,316.00	515,961,018.00
Total	**2,171,760,759.32**	**1,948,737,679.32**

Sd/-

R .S. Gururaj
Accounts Officer

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

Description	2013-14	2012-13
	Rs. Ps.	Rs. Ps.
SCHEDULE 9- Investments -Earmarked/Endowment Funds:		
Long Term Deposits		
Fixed Deposits with HDFC (Trust Deposits)	86,705,500.00	80,705,500.00
Fixed Deposits with Canara bank	113,908,000.00	103,908,000.00
Fixed Deposit with SBI	61,500,000.00	61,500,000.00
Interest accrued on Fixed Deposits with banks	9,053,237.00	1,870,617.00
Total	**271,166,737.00**	**247,984,117.00**
SCHEDULE 10- Investments - Others		
Short Term Deposits - SCHEMES	0.00	0.00
Total	**0.00**	**0.00**
Schedule 11 Current Assets, Loans, Advances etc.,		
Cash & Bank Balances (Schemes)		
Cash in hand - Schemes Account	1,643.00	55,672.00
Cash at Bank -Schemes - Canara Bank	34,040,042.46	2,053,282.46
Interest accrued on FD	0.00	3,225,055.00
Fixed deposit with Canara Bank (Schemes)	65,000,000.00	230,000,000.00
	99,041,685.46	**235,334,009.46**
Cash & Bank Balances - Centre		
Cash in hand Grant Account	119,162.00	38,354.00
Cash in hand Endowment Account	14,926.00	0.00
Cash at Bank - Canara Bank	3,000,144.13	8,615,603.05
Cash at Bank - Union Bank	175,103.00	168,304.00
Cash at Bank - SBI	142,881.00	1,729,686.00
Imprest balance	0.00	30,472.00
	3,452,216.13	**10,582,419.05**
Loans and Advances		
Advances to staff	1,314,699.00	644,120.00
Other advances & Receivables	5,028,217.00	7,430,581.40
TDS receivable	3,165,412.00	2,425,310.00
	9,508,328.00	10,500,011.40
Total	**112,002,229.59**	**245,916,428.51**

Sd/-
R .S. Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2013-14	2012-13
	Rs. Ps.	Rs. Ps.
SCHEDULE 12-Income from sales / services	0.00	0.00
	0.00	0.00
SCHEDULE 13-Grants/subsidies :		
Grants - DST	550,000,000.00	490,200,000.00
Grants - From Governement agencies/Travel grants etc.	8,000.00	16,600,000.00
Grants - From other Institutes	10,000,000.00	6,000,000.00
Grants - Other international agencies	2,400,000.00	0.00
Total	**562,408,000.00**	**512,800,000.00**
SCHEDULE 14-Income from Fee/Subscriptions etc :		
Income from fee, subscriptions,medical contribution etc.,	1,622,426.00	1,582,050.00
Total	**1,622,426.00**	**1,582,050.00**
SCHEDULE 15-Income from investments;	0.00	0.00
SCHEDULE 16-Royalty Income,Publication,Licence fee etc :		
From Royalty	1,462,539.34	2,904,764.05
Licence fee	177,089.00	80,933.00
Total	**1,639,628.34**	**2,985,697.05**
SCHEDULE 17-Interest earned:		
From Term deposits	14,179,240.00	4,499,757.00
From SB acounts with nationalised banks	2,697,737.00	2,708,071.00
Total	**16,876,977.00**	**7,207,828.00**
SCHEDULE 18-Other income:		
From Visitors house,Guest rooms,Students residense etc,	4,291,824.00	4,082,132.00
CSIR Fellowships, ICMS, SRFP reimbursement etc,.	18,332,811.00	23,561,441.00
Overhead recoveries	8,000,000.00	16,000,000.00
From others(tender fee & other fee collected)	996,044.00	746,046.21
Total	**31,620,679.00**	**44,389,619.21**
SCHEDULE 19 - Increase / Decrease in stock:	0.00	0.00

Sd/-
R .S. Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2013-14	2012-13
	Rs. Ps.	Rs. Ps.
SCHEDULE 20 Establishment Expenses:		
Salaries & Scholarship to students	163,970,429.00	144,888,858.00
Wages	38,298,575.00	39,473,208.00
Allowances (Medical reimbursements etc.,)	5,558,176.00	7,003,149.00
Bonus	263,057.00	221,240.00
Contribution to CPF	2,643,418.00	2,656,881.00
Contribution to New Pension Sceme	3,562,799.00	2,941,969.00
Contribution to Group Gratuity Scheme	1,500,000.00	1,500,000.00
Leave Encashment Benefits	364,835.00	258,746.00
Retirement & Terminal Benefits	1,266,445.00	1,128,603.00
LTC	989,290.00	2,921,115.00
Total	**218,417,024.00**	**202,993,769.00**
SCHEDULE 21- Other Administrative expenses		
Electricity & Power	40,023,743.00	40,922,192.00
Water charges	5,362,157.00	5,565,111.00
Insurance	617,378.00	565,663.00
Repairs & Maintenance	34,779,375.00	38,785,984.00
Rents, Rates & Taxes	2,367,586.00	687,833.00
Vehicles Running & Maintenance	7,351,594.00	7,167,385.00
Postage, Telephone & Communication	3,625,713.00	5,416,472.00
Printing, stationery,Books	5,749,447.00	6,754,251.64
Travelling and conveyance	5,062,609.00	6,627,980.00
Expneses on Seminars/workshops/discussion meetings	10,888,908.97	8,543,600.73
Membership & Subscriptions	565,634.00	414,794.00
Fees towards Training etc.,	113,132.00	769,351.00
Professional charges	11,557,824.00	10,805,498.00
Laboratory Consumables	55,035,767.76	48,776,565.00
Frieght Inwards	1,926,662.00	2,365,412.00
Other Consumables	2,726,251.00	2,334,326.00
Advertisement & Publicity	2,087,796.00	2,935,832.00
Other miscellaneous expenses	2,261,056.00	2,283,998.38
Statutory Audit fee	56,180.00	56,180.00
POBE & POCE prgramme	1,144,055.00	1,576,978.50
Summer Research Fellowship Programme	508,578.00	533,843.00
ICMS - Workshops, Schools etc,.	892,733.00	1,050,254.00
ICMS - Visitor Programmes (National & International)	689,146.00	735,081.00
ICMS - Recurring Expenses	5,449,657.00	4,582,181.00
ICMS - Scientists & Supporting Staff	4,758,355.00	3,266,095.00
Total	**205,601,337.73**	**203,522,861.25**
SCHEDULE 22-Expenditure on grants, subsidies Etc:	0.00	0.00
SCHEDULE 23- Interest and Bank charges:	35,472.88	154,192.00
Total	**35,472.88**	**154,192.00**

Sd/-
R .S. Gururaj
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

SCHEDULE 24

Accounting Policies for the year 2013-14

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. Fluctuations in foreign currency on account of procurement of fixed assets are capitalized with the respective fixed asset.

R.S.Gururaj.
Accounts Officer

Prof.K.S.Narayan
PRESIDENT IN CHARGE

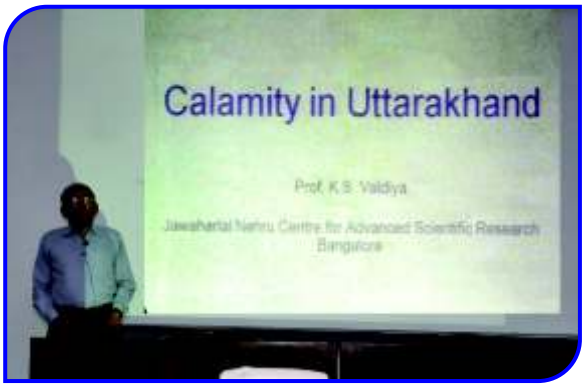
Place: Bangalore
Date : 22.09.2014

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

(G R Venkatanarayana)
Partner
Membership No.18067

Mr. Satyendra Nath receiving Best Staff Award,
2013 on July 07, 2013

Book Release programme of book titled
'CNR Rao Anokhya Rasayanana Banela Manus' on Nevill Mott Hall,
ICMS, on July 13, 2013



Special Lecture: Calamity in Uttarakhand, by
Prof. K.S. Valdiya, JNCASR, on July 17, 2013

Prof. V. Ramalingaswami Memorial Lecture,
by Dr. M.K. Bhan, Former Secretary Dept. of Biotechnology,
New Delhi on July 18, 2013.

Inauguration of Sheikh Saqr Laboratory Building by
Highness Sheikh Saud Bin Saqr Al Quasimi
on August 26, 2013.

Conferment of the Honorary Fellowship
to His Highness Sheikh Saud Bin Saqr Al Quasimi
on August 26, 2013.

Prof. Nuyori, Nobel Laureate,
delivering Linus Pauling Lecture at Conference Hall,
AMRL on September 16, 2013

Signing of MoU between RIKEN, Japan, JNCASR and IISc,
Bangalore on September 16, 2013

Sheikh Saqr Laboratory Building

Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bangalore - 560064

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