

Jawaharlal Nehru Centre for Advanced Scientific Research

*A coffee-table book to celebrate 25-year long journey of JNCASR
was released by Hon'ble Vice President of India, Dr Hamid
Ansari at the Closing Ceremony of JNCASR Silver Jubilee*



*JNCASR-Purdue University Meeting,
March 20-21, 2015*



*Program in Chemistry (Jointly organised
with NCU), September 22, 2014*

**ANNUAL REPORT
2014-15**



*International Conference on Chromosome Stability, JNCASR,
December 14-18, 2014.*



*Gene networks in chromatin /chromosome function, 5th Meeting of
the Asian Forum of Chromosome and Chromatin Biology, JNCASR,
January 15 - 18, 2015*



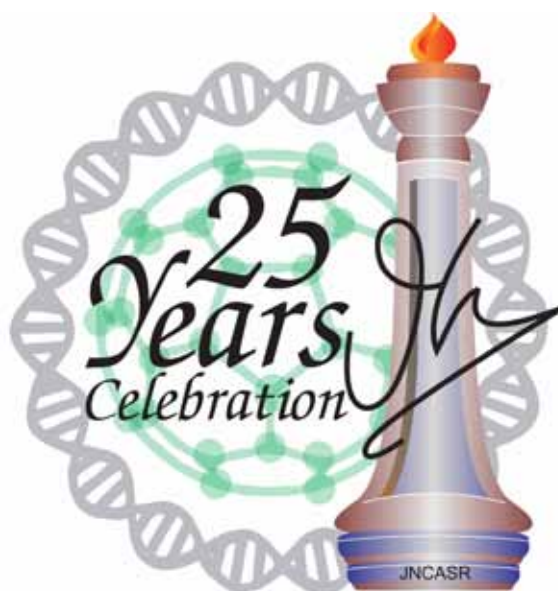
European Union and Indo-Italy Meeting, March 10-14, 2015



*JNCASR received 1st prize for the Best Maintained
Garden for the year 2014 instituted by the Mysore
Horticultural Society, Lalbagh, Bangalore.*

ANNUAL REPORT

2014-15



**JAWAHARLAL NEHRU CENTRE FOR
ADVANCED SCIENTIFIC RESEARCH**

(A Deemed to be University)

Jakkur, Bengaluru – 560 064

Website: <http://www.jncasr.ac.in>

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THE CENTRE

Foreword

I have great pleasure in presenting the Twenty Sixth Annual Report for the year 2014-15.

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

There is a steady increase in the number of research students in the Centre pursuing various academic programmes. The present student strength is 290. Forty two students joined the Centre during August 2014 admission and ten during mid-year admission in January 2015. Twenty students were awarded Ph D degrees, eight with M S (Materials Science), ten with M S (Eng.), six with M S in Biological Sciences and seven 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.

The beginning of year 2015 marked the end of our year long celebrations of Silver Jubilee of the establishment of the Centre. Lectures from eminent scientists have been delivered during the year-long celebration. The celebration was concluded with a visit and closing remarks by Honourable Vice-President of India, Dr. Hamid Ansari. A coffee-table book to celebrate 25-year long journey of JNCASR was also released by Dr Ansari during the Ceremony.

It's a matter of great pride that one of Centre's long associate, Prof K S Valdiya has been conferred upon the prestigious Padma Bhusan award of 2015. Prof C N R Rao has received the honorary membership of the Chinese Academy of Sciences. Many of other faculty colleagues have received awards and honours during the year.

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. Series of teachers/students programs/workshops for school and pre-university colleges deserve a special mention in this direction.

During the financial year, 24 patent applications (International Patent Application under PCT-5, Korea-2, Australia-1, Canada-1, USA-6, India-5, Europe-4) were filed and 12 patents (USA-5, India-2, Europe-1, Japan-3, China-1) were obtained. To date, the Centre has filed 193 patent applications (India-65, PCT-42, USA-43, Europe-18, Japan-6, China-5, Korea-4, Australia-3, S.Africa-2, Brazil-2, Vietnam-1, Israel-1, Canada-1) and obtained 40 patent grants (India-8, USA-20, Europe-4, Japan-3, S.Africa-2, Australia-1, Korea-1, China-1), in addition to registering one Industrial Design and one Trade Mark.

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

The infrastructure is being constantly upgraded and some new facilities and buildings have come up or are in process of completion. Among the ones under construction are the Post-Doc Housing, new building for Biology Research and Auditorium. All these developments were possible with the continuous support from the Department of Science and Technology, Govt. of India.

K S Narayan
In-Charge President

INTRODUCTION

The Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, a premier research institute in the country, was established in the year 1989, the birth centenary year of Pandit Jawaharlal Nehru, by the Department of Science and Technology. The objectives of the institute shall be to pursue and promote scientific research and training at the highest level in the frontier and interdisciplinary areas of science and engineering. The number of publications in international journals of repute and the filing of patents are steadily increasing year by year. The Centre, which is just twenty three 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.



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 Centres like the Thematic Unit of Excellence in Computational Materials Science and Thematic Unit of Excellence in Nanochemistry are the newer in the lot. The Nanoscience Centre is equipped with the state of the art facilities for advanced research in materials science. Neuroscience Unit is the newly established unit of the Centre.

The Centre is equipped with good quality library, an excellent computer support facility, lecture halls, Chemical Education Laboratory, conference and seminar halls, faculty offices and the administrative office. A seminar hall, a well-furnished accommodation for academic visitors and a Visitor House are also located at IISc campus.

During the year, forty two students joined the Centre during August 2014 admission and ten during mid-year admission in January 2015. Twenty students were awarded Ph D degrees, eight with M S (Materials Science), ten with M S (Engg.), six with M S in Biological Sciences and seven students were awarded M S in Chemical Sciences. In addition, two students were awarded the Postgraduate Diploma in Science Education (PGDSE) and three students were awarded the Postgraduate Diploma in Materials Science (PGDMS). Currently about 290 scholars are pursuing their research career. The research and training at the Centre has led to the award of 179 Ph D degrees, 55 M S (Engg.), 3 M S (research), 86 M S (of Int Ph D), 1 M Sc (by research) degrees and 5 PGDSE and 5 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 K S Valdiya received Padma Bhushan Award for the year 2015. Prof C N R Rao was chosen as one of the 25 Greatest Global Living Legends by NDTV. He also received honorary D Sc from the University of St Andrews, UK and Australian National University. He was also selected as Foreign Member of the Chinese Academy of Sciences; Corresponding Member of the Australian Academy of Sciences; and Honorary member of the Nepal Academy of Science and Technology. Prof M R S Rao received Distinguished Alumnus Award for the year 2014 by Alumni Association of IISc; Prof Roddam Narasimha received IETE Diamond Jubilee Medal awarded by the Institution of Electronics and Telecommunication Engineers, New Delhi and Senior Guru award by Alumni Association of IISc. Mrs Indumati Rao received Honorary Doctorate in Literature from the Karnataka State Women's University, Bijapur. Prof Umesh V Waghmare was the recipient of Gold Medal of the Indian Institute of Metals. Prof Vijay Kumar Sharma and Dr Sheeba Vasu were invited to deliver plenary lectures in the bi-annual meeting of Society for Research in Biological Rhythms (SRBR) organized in Big Sky, Montana, USA from June 14-18, 2014. Prof Shobhana Narasimhan named one of "*India's most Inspiring Women Engineers and Scientists*" by Engineering Watch. Prof Srikanth Sastry received Distinguished Alumnus Award 2015. From IIT Bombay Prof Meheboob Alam received Outstanding Referee Award (2014) from American Physical Society's Physical Review and Physical Review Letters Journals. Prof Tapas K Kundu received the first Silver Jubilee Professorship donated by the C N R Rao Education Foundation. Dr M Eswaramoorthy and Dr Subi J George were the recipients of CRSI bronze medals for the year 2015. Dr George was chosen as *Emerging Investigator* by Journal of Materials Chemistry (2014). Dr Tapas K Maji received Materials Research Society of India (MRSI) Medal 2014 and Humboldt Fellowship for Senior Researchers (2015-2017). Dr Sebastian C Peter chosen as Young and Outstanding Scientist in Solid State Chemistry by the American Chemical Society (ACS). Dr Ranjani Viswanatha received INSA Young Scientist Award -2014. Dr TNC Vidya was nominated by INSA



to represent the country as a Young Leader at the Young Leaders' Programme, at the Annual Meeting of the Science and Technology in Society Forum in Kyoto, Japan. Dr Ujjal Gautam was selected as the most influential scientific minds 2014 by Thomson Reuters. Prof C P Rajendran's work on Himalayas published in Science Magazine and broadcast on Rajya Sabha TV.

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 434 scientific papers in reputed international journals during the year 2014-15, 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.

Under Visiting Fellowship Programme, 11 scientists from different institutions across the country were selected and placed in MBGU, CPMU or TSU for a period of three months tenable between October 2014 -September 2015. For Summer Research Fellowship Programme, 1300 applications were received and 69 scholarships were offered for the year 2015. For Project Oriented Biological Education (POBE) and Project Oriented Chemical Education (POCE), 10 students were selected for each programme from over 500 applications received. Three students received Diploma certificates in Biology this year. Six scientists were shortlisted under the JNCASR-CICS Fellowship Programme 2015-16 from Nigeria, Uzbekistan, Ethiopia, Sri Lanka, Zambia and Cameroon.

During the financial year 2014-15, eight Discussion Meetings, 17 international conferences, workshops, and symposia were supported, either wholly or partially by the Centre. Around 51 seminars were held in addition to 6 Endowment Lectures, 12 Fluid Dynamic Colloquia, 2 Silver Jubilee and 2 Special Lectures delivered by eminent scientists.

HIGHLIGHTS OF RESEARCH AND OTHER ACTIVITIES

RESEARCH

Chemistry and Physics of Materials Unit (CPMU)

MD simulations of oligomers of PfHGXPRT enzyme have been carried out in order to study its dynamics, function, free energy landscape and product release. This work has shown the importance of the dynamics of Loops II and IV in ligand binding and activity of the enzyme.

Transparent conductors have been developed based on interconnected metal wire networks with optoelectronic properties better than conventional oxide films. Using these networks, several optoelectronic devices have been fabricated including transparent solar cells.

Gold microcrystals in the form of pentagonal bipyramidal rice-like morphology have been synthesized and by inducing large amount of strain in the structure, non-cubic phases have been obtained.

A simple method to prepare turbostratic graphene has been developed. Thus produced graphene, is found to exhibit Raman spectra akin to single layer graphene.

A new family of magnetoelectric material based on spinel structure with magnetic ions only at the A-site (AB_2O_4 where A=magnetic ions and B=nonmagnetic ions) has been discovered.

Education Technology Unit (ETU)

As a recognition to Mrs Indumati Rao's contributions to the popularizing of science education, Honorary Doctorate in Literature was conferred upon her by the Karnataka State Women's University, Vijayapura.

During 2014-15, highly popular lectures/workshops for students and teachers have been conducted in different subjects like Physics, Chemistry and Biology. The Summer 2014 Science Outreach Programme (SOP) was conducted in association with Himalayan Gram Vikas Samiti, Gangolihat by Prof K S Valdiya. At CSIR-Indian Institute of Petroleum, Dehradun, Prof C N R Rao gave lecture titled 'Celebration of Science'. Eight lecture programs were conducted during 2014 for students and teachers. A program with New Chemistry Unit was organised for students and teachers of XI and XII classes. A program for students and teachers was organized at Trivandrum where Prof C N R Rao gave the lecture 'New forms of Carbon (Nanocarbons)'. Program in chemistry was organized in which Prof Bert Meijer and Prof C N R Rao gave lectures followed by a multimedia presentation by Mrs Indumati Rao. 'INSPIRE Program' was organised for the students participating in INSPIRE camp. A workshop for doing experiments using the College Chemistry kit was organized by Science Outreach Program-Project Oriented Chemical Education (SOP-POCE). A program was organized for students and teachers at the Vivekananda Global University, Jaipur. Prof C N R Rao delivered lecture 'A Celebration of Chemistry' to students and teachers at the Ras Al Khaimah Center for Advanced Materials. A lecture programme was organised for students and teachers in Jorhat.

Production of the print-ready copy was started for the book titled 'New forms of Carbon (Nanocarbons)' authored by Prof C N R Rao.

Shri Narayan Vitthalrao Babanagar and Dr Shripal Rathi were the recipients of the C N R Rao Education Foundation sponsored 2013 prizes for Outstanding Science Teachers.

Evolutionary and Organismal Biology Unit (EOBU)

During the year 2014-2015, the faculty of EOBU continued to conduct research in the broad areas of animal behavior, phylogeography, chronobiology, evolutionary genetics, neurogenetics, neurodegenerative disorders, and population dynamics.

The Unit also continued to train personnel in the area of organismal biology through the Ph D, Integrated



PhD and M S programmes. Faculty members of the Unit have also participated in extension programmes like, Project Oriented Biological Education (POBE) and Summer Research Fellowship programme (SRFP) of the Centre as well as similar outreach programmes run by the three Indian Science Academies and by DST and KVPY.

Geodynamics Unit (GDU)

Research work was undertaken towards understanding the earthquake mechanisms, post-seismic processes and plate deformation along the Andaman-Nicobar subduction zone using geological, seismological and GPS data. Substantial work has also been conducted to understand the earthquake hazard in the central Himalaya. Further, new proposals have also been formulated on seismic hazards and also climatic evolution in India.

Under earthquake/tsunami recurrence studies in Andaman Islands, a major program was started to develop a robust chronological database on the Indian Ocean tsunami history from deep coring in the area that was subsided in 2004 near Port Blair. The cores are expected to preserve bands of tsunami depositions alternating with regular cycles of tidal sedimentation. This is the first attempt to generate a continuous record of tsunami/earthquake recurrence in the Indian Ocean. Crustal deformation studies in these Islands revealed that more than ten years after the great (Mw 9.2) Sumatra-Andaman earthquake, the Global Positioning System (GPS)-based displacements in the Andaman and Nicobar Islands indicated that early near-field motions were dominated by slip down-dip of the rupture. In Andaman-Nicobar subduction zone earthquake studies have revealed that the 1300-km-long rupture zone of the 2004 Andaman–Sumatra mega-thrust earthquake continues to generate a mix of thrust, normal, and strike-slip faulting events. Researchers of this Unit observed that the subducting plate off the Sumatra and Nicobar segments can be considered as a chip of the India–Australia plate, deforming in response to a generally northwest-southeast oriented compression, an aspect that must be factored into the plate deformation models.

Studies related to earthquake recurrence in the central Himalaya have been initiated to understand the earthquake recurrence pattern in the region. Research results of these studies suggest spatio-temporal clustering of great earthquakes in the medieval times in the central Himalaya and this segment appears to be mature to generate a great earthquake.

Molecular Biology and Genetics Unit (MBGU)

Prof Namita Suroliá's research group focused on molecular mechanisms underlying cerebral malaria pathogenesis; functional characterization of Plasmodium falciparum centromeric proteins CENP-A and CENP-C; role of autophagy in Plasmodium falciparum. A protein-protein interaction network using 'Systems' approach was created on global gene expression profile from parasite RNA isolated from peripheral blood samples of patients suffering from severe non-cerebral and cerebral malaria. The research group had functionally characterized both the centromeric proteins PfCENPA and PfCENPC from this parasites, by complementation assays. These studies are first of its kind as no experimental studies on centromeric proteins from this important parasites have been carried out till date.

In HIV-AIDS Laboratory, proviral DNA load in nine different brain regions were examined. Three different peripheral tissues derived from ten human subjects at autopsy and identified uniform proviral distribution among the brain compartments were examined without preferential accumulation of the DNA in any one of them.

In Vascular Biology Laboratory, a novel mechanism for maintenance of stem cell potency by endosomal regulation was proven. Several Drosophila models of leukemia were generated. Knockout mice for the endosomal protein Asrij has been identified and showed that mice lacking Asrij develop a blood cell disorder. Hence, a novel model for studying human hematopoietic disorders was developed. It was found that human embryonic stem cell differentiation is regulated by Asrij.

In Chromatin Biology Laboratory, researchers have reported the identification of different PTMs, such as acetylation, methylation, and phosphorylation of a major mammalian histone variant TH2B. Their mass

spectrometric analysis has led to the identification of both conserved and unique modifications across tetraploid spermatocytes and haploid spermatids.

In Autophagy Laboratory studies were undertaken at multiple aspects of autophagy biology using yeast, mammalian cells and mouse models. The laboratory has identified small molecules that regulate autophagy in both yeast and mammalian systems. To identify these small molecules, a high throughput screening of several libraries consisting of ~200,000 compounds was screened at UCLA using an in-house developed real time autophagy assay.

Neuroscience Unit (NSU)

In the area of neurooncology, it is found that Aebp1 is a transcription factor involved in adipogenesis. In a transcriptome analysis of graded patient glioma samples, it was discovered as one of the genes to be up regulated in majority of the primary GBM.

Researchers have worked in the area of cellular mechanisms of human mind disorders. Studies have discovered that a cardinal feature of human brain development is that sensory, cognitive and emotional experiences shape synapses and neural-circuit development.

Epilepsy is a relatively common brain disorder defined by recurrent and unprovoked seizures. To identify the causative gene at EIG8, detailed genetic studies were conducted revealing six mutations in the CASR gene, present exclusively among GGE/JME patients. The six mutations identified are rare and missense changes altering highly conserved CASR residues: p.Glu354Ala, p.Asp433His, p.Ser580Asn, p.Ile686Val, p.Arg898Gln and p.Ala988Val.

Progress has been reported in development of biomaterials for interfacing sensory organs, as the electronic characteristics of certain conjugated polymers have been used for sensing and stimulating neuronal activity. The use of these novel optoelectronic features of organic semiconductor based polymer layers have been explored in contact with physiological media and these structures have been utilized as an interface to evoke neuronal signals in a blind retina.

New Chemistry Unit (NCU)

Several aspects of the chemistry of materials are being pursued by Prof C N R Rao. 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 MoS₂ and TaS₂. A recent area of research Prof. Rao is involved in is artificial photosynthesis based on inorganic nanomaterials. These studies include oxidation as well as reduction of water.

In Dr T Govindaraju's group, major research efforts were in the development of diagnostics and therapeutics for currently incurable neurodegenerative diseases such as Alzheimer's (AD) and Parkinson diseases (PD). The research group has worked towards the development of molecular probes detecting AD-biomarkers in cerebrospinal fluids (CSF), blood and brain samples, to be used as viable tools for early diagnosis of AD. They have been working on developing probes for (bio)metals that are directly implicated in AD which are currently used to probe and discover therapeutics targeting metal-pathway in AD. His group has worked towards developing synthetic technology to produce biomimetics of functional amyloids (e.g., spider silk) and their applications as biomaterials.

Dr Subi J George's research group has been working extensively on the mixed-stack charge-transfer assemblies for electronic and ferroelectric functionality and also to use them as reversible (stimuli responsive) supramolecular motif to control the functional properties like pore transport and adsorption properties of inorganic porous



materials. His group has also designed solution processable, luminescent organic-inorganic hybrids by the co-assembly ionic dyes and nanoclay particles to modulate various photo-physical and photochemical processes.

In Dr Jayantha Haldar's research group a novel vancomycin analogues has 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. Additionally, the research group investigated anti-inflammatory properties of macromolecular mimic of AMPs and their ability to target intracellular pathogens by synergistic co-delivery of antibiotics in combination with antibiotics in targeting the persister cells that play an important role in bio-films.

Dr Kanishka Biswas' research group has discovered a new class of materials, cubic I-V-VI₂ (where I = Cu, Ag alkali metal; V = Sb, Bi; and VI = S, Se, Te) semiconductors, which can possess very low thermal conductivity thus can give rise to high thermoelectric performance. Last year, promising thermoelectric materials have been developed based on Pb-free SnTe_{1-x}Sex system, which has immense importance in industry.

Dr Ranjani Viswanatha's group 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. Using this novel technique, she has explored the conduction band and valence band variation as a function of size as well as 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's group has designed novel rare earth based intermetallics with diverse structural features tuned with interesting physical properties. Two examples are: intrinsic magnetic exchange bias and spin glass behavior.

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. 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 K Pati's group has studied in detail the effect of the spatial distribution of B, N and C domains in 2-dimensional borocarbonitrides and its influence on carrier mobility. The multifunctional behavior of two-dimensional transition metal embedded g-C₃N₄ with and without graphene support showed significant promise for application in various fields such as in memory devices and for photo-catalysis.

Dr Sridhar Rajaram's group developed a clear understanding of the charge transfer dynamics in twisted perylene solar cells. The nature of phase segregation in blends of polymer and twisted perylene was studied using a ferroelectric matrix. Using these inputs they have further pushed the efficiencies of perylene containing cells.

Theoretical Sciences Unit (TSU)

Dr Subir Das' research group was involved in addressing problems related to equilibrium and nonequilibrium statistical mechanics.

Dr Kavita Jain's research group has calculated a steady state correlation function in a class of nonequilibrium processes. Studies were undertaken to explore the large time properties of a finite population with arbitrarily high mutation rates.

Prof Shobhana Narasimhan's group worked on gas storage and thermal energy storage applications. It was shown that all three types of van der Waals interactions (London, Debye and Keesom) can be tuned for carbon-based substrates, by suitable modification of the substrate.

Dr Meher Prakash's research group performed research activity focusing on understanding function of proteins molecular dynamics.

Prof Srikanth Sastry's research group focused on understanding the nature of yielding and memory in amorphous solids, shear jamming of sphere assemblies, and the nature of fragility in glass formers.

Members of the Materials Theory group led by Prof Umesh V Waghmare predicted ferroelectricity in the 1T form of MoS₂ and determined structures of 1-dimensional defects in graphene and h-BN. Experimental work has been complemented on use of layered materials in photo-catalytic splitting of water using solar energy with first-principles simulations.

Dr N S Vidhyadhiraja's research group's one of the research achievements was the development of an open source software package, named MO-IPT. This package is built for use by the strongly correlated electronic systems community and is capable of producing real frequency density of states, at all interaction strengths and temperatures.

International Centre for Materials Science (ICMS)

Prof C N R Rao's group has initiated two major programmes on energy research: one related to artificial photosynthesis involving photocatalytic oxidation of water by nanoparticles of Mn and Co oxides and the other on photocatalytic H₂ generation by hybrid nanostructures by using the Z-scheme, synthesis, characterization and properties of anion substituted metal oxides and sulfides where in oxygen is replaced by nitrogen and fluorine and sulfur by phosphorous and chlorine were investigated.

Dr Sridhar Rajaram's research group developed a clear understanding of the charge transfer dynamics in twisted perylene solar cells. The nature of phase segregation in blends of polymer and twisted perylene was studied using a ferroelectric matrix.

Dr Ranjan Datta's research group has undertaken work in the areas such as: nanoscale optical band gap measurement from defects, cation mixing and regular structure for various inverse spinel thin films by HREELS.

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. Using this novel technique, she explored the conduction band and valence band variation as a function of size as well as 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 Rajesh Ganapathy's research group has primarily attempted to shed light on the nature of the glass transition. Recent simulations have suggested that biasing the thermodynamics of a supercooled liquid by pinning a subset of particles might help unravel the conundrum.

Prof S M Shivaprasad's research group has performed Nano-ELOG growth of GaN and InN thin films on the nanowall network as template, which yield high quality, low defect thin films with unprecedented structural, optical and electrical properties. It was found that nitriding the c-plane sapphire prior to growth results in an improvement of crystalline quality of the resulting nanowall as observed by the reduction in FWHM of (0002) XRC.

Academic Activities

Forty two students joined the Centre during August 2014 admission and ten during mid-year admission in January 2015. Twenty students were awarded Ph D degrees, eight with M S (Materials Science), ten with MS (Eng.), six with M S in Biological Sciences and seven students were awarded M S in Chemical Sciences. In addition, two students were awarded the Postgraduate Diploma in Science Education (PGDSE) and three students were awarded the Postgraduate Diploma in Materials Science (PGDMS).



Fellowships & Extension Programmes

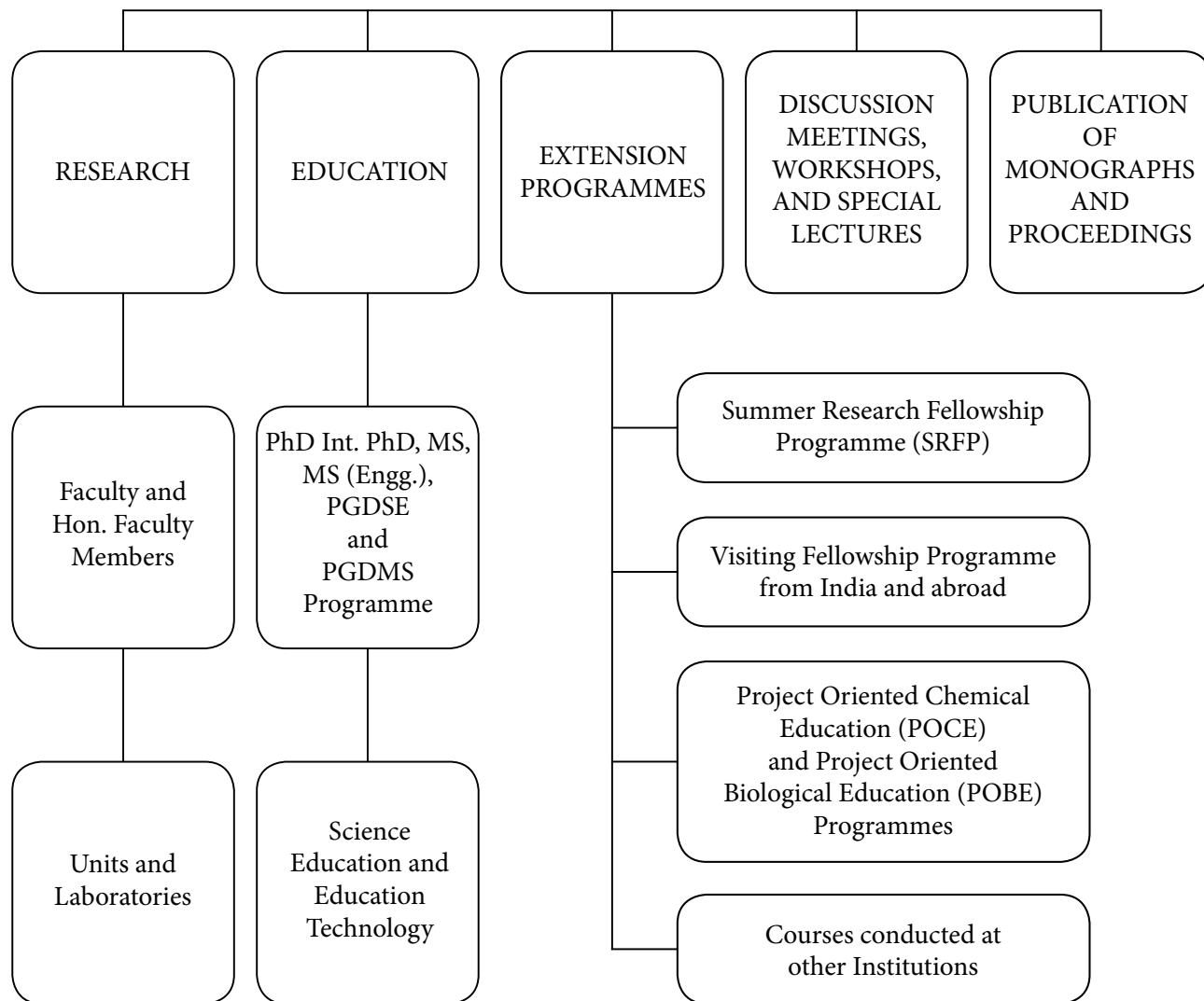
Under Visiting Fellowship Programme, 11 scientists from different institutions across the country were selected and placed in MBGU, CPMU or TSU for a period of three months tenable between October 2014 -September 2015. For Summer Research Fellowship Programme, 1300 applications were received and 69 scholarships were offered for the year 2015. For Project Oriented Biological Education (POBE) and Project Oriented Chemical Education (POCE), 10 students were selected for each programme from over 500 applications received. Three students will receive Diploma certificates in Biology this year. Six scientists were shortlisted under the JNCASR-CICS Fellowship Programme 2015-16 from Nigeria, Uzbekistan, Ethiopia, Sri Lanka, Zambia and Cameroon.

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.

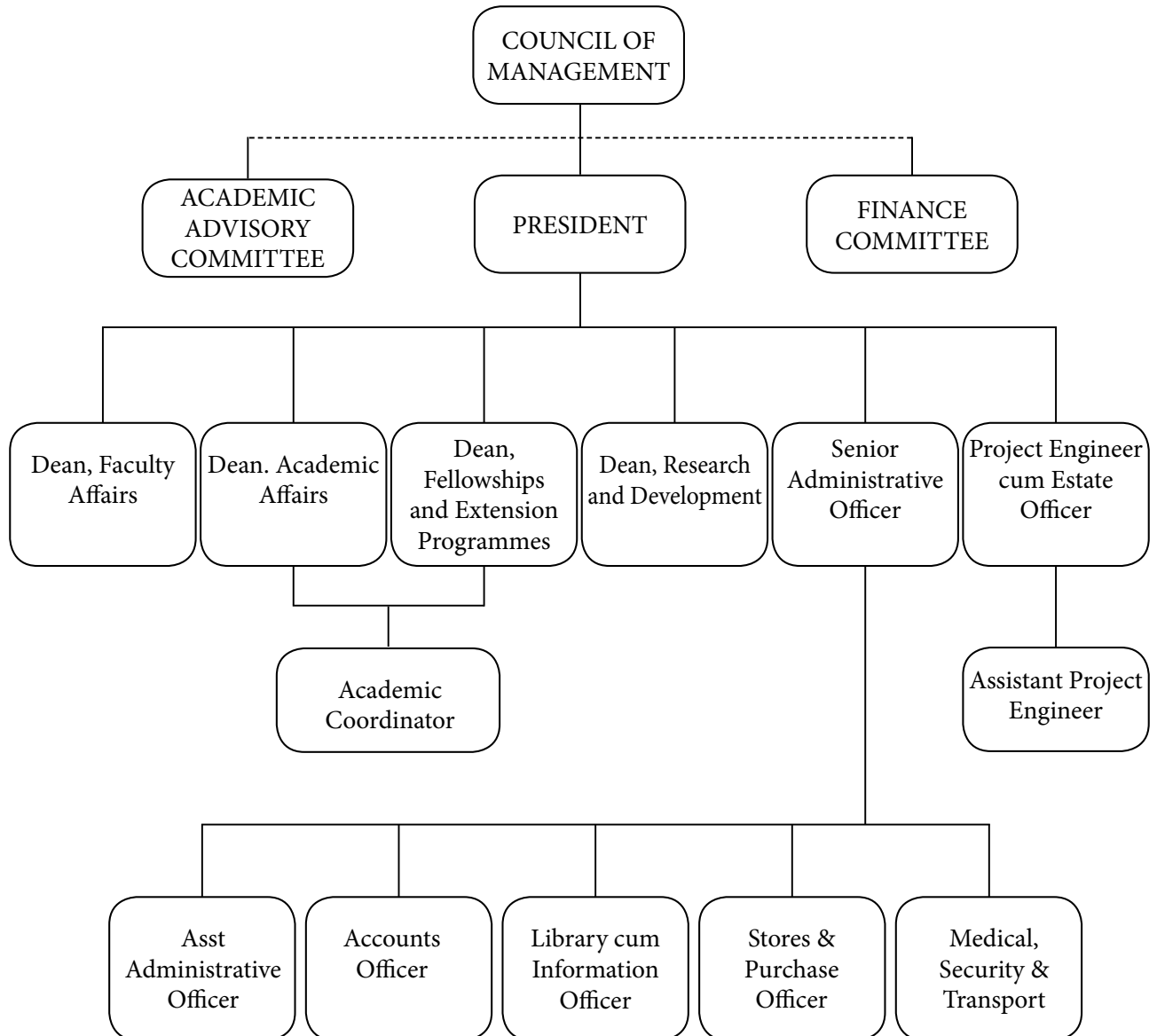
ACTIVITIES CHART

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH



ORGANIZATION CHART

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH



THE ORGANIZATION

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 – Chairman

Hyderabad

Prof K S Narayan – Member

In-Charge President, JNCASR

Prof C N R Rao – Member

Hon. President, JNCASR (JNC nominee)

Prof Ashutosh Sharma – Member

Secretary, Department of Science & Technology

Shri J B Mohapatra (2011-14) – Member (Ex-officio)

Joint Secretary & Financial Adviser

Department of Science & Technology

Dr Baldev Raj (2011-14) – Member

Director, NIAS

Prof Chandan Dasgupta (2011-14) – Member

IISc (IISc nominee)

Prof S K Joshi – Member

NPL, New Delhi (UGC nominee)

Prof Anurag Kumar – Member

Director, IISc

Shri A N Jayachandra – Secretary

Sr. Administrative Officer, JNCASR



THE FINANCE COMMITTEE

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

The constitution of the Finance Committee is as follows:

Prof K S Narayan – Chairman (Ex-officio)

In-Charge President, JNCASR

Prof C N R Rao – Member

National Research Professor

Shri J B Mohapatra – Member

Joint Secretary & Financial Adviser, DST

Shri R S Gururaj – Member (Ex-officio)

Accounts Officer JNCASR

Prof Chandan Dasgupta – Member

Dean, Undergraduate Studies, IISc

Shri A N Jayachandra – Secretary (Ex-officio)

Sr. Administrative Officer

THE ACADEMIC ADVISORY COMMITTEE (AAC)

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

The members of the Academic Advisory Committee are:

Prof K S Narayan – Chairman (Ex-officio)

In-Charge President, JNCASR

Prof Hemalatha Balaram(2013-16) – Member (Ex-officio)

Dean, Faculty Affairs, JNCASR

Prof Shobhana Narasimhan (2013-16) – Member (Ex-officio)

Dean, Academic Affairs, JNCASR

Prof Maneesha S.Inamadar (2012-14) – Member (Ex-officio)

Dean, Fellowships and Extension Programmes, JNCASR

Prof K S Narayan (2012-14) – Member (Ex-officio)

Dean, R&D, JNCASR

Prof V Nagaraja (2012-14) – Member

Professor, MCB, IISc

Prof U Ramamurty(2012-14) – Member

Professor, Mat. Engg., IISc

Prof George K Thomas (2012-14) – Member

IISER, Thiruvananthapuram

Prof D D Sarma (2012-14) – Member

SSCU, IISc

Prof Devang V Khakhar (2012-14) – Member (*UGC Nominee*)

Director, IIT, Mumbai

Shri A N Jayachandra – Secretary (Ex-officio)

Sr Administrative Officer, JNCASR



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 January 2015 which included lectures by the faculty on the advances made in various research areas.

ADMINISTRATION

President (In-Charge)

K S Narayan – Ph D (Ohio State Univ., USA)

Dean, Faculty Affairs

Hemalatha Balaram – Ph D

Dean, Academic Affairs

Shobhana Narasimhan – Ph D (IISc)

Dean, Fellowships and Extension Programmes

Maneesha Inamdar – Ph D

Dean, Research and Development

K S Narayan – Ph D (Ohio State Univ., USA)

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 Co-ordinator

Princy Jaison Pereira – Ph D (Gujarat)

Accounts Officer (SG)

R S Gururaj – B.Sc. (Mysore) M P Ed (Bangalore)

Jr Accounts Officer

Venkatesulu B – B.Sc. (Gulbarga)

Stores & Purchase Officer

K Bhaskara Rao – M.Sc. (Hyderabad), M Phil (New Delhi)

Sr 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 Project Engineer (Civil)

Veerasha N R – DCE

Assistant Project Engineer (Elec.)

Sujeeth Kumar S – DEE

Consulting Medical Officer

G R Nagbhushan– 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

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 (CPMU)

Research Activities

MD simulations of oligomers of PfHGXPRT enzyme have been carried out in order to study its dynamics, function, free energy landscape and product release. The studies have shown the importance of the dynamics of Loops II and IV in ligand binding and activity of the enzyme. Hydrogen bonding in alkylammonium based protic ionic liquids was studied using density functional theory (DFT) and ab-initio molecular dynamics (AIMD) simulations. Normal-mode analysis within the harmonic approximation and power spectra of velocity autocorrelation functions were used as tools to obtain the vibrational spectra in both the gas phase as well as in the crystalline phases of these protic ionic liquids.

Transparent conductors were developed based on interconnected metal wire networks with optoelectronic properties were better than conventional oxide films. Using these networks, several optoelectronic devices were fabricated including transparent solar cells.

Gold microcrystals in the form of pentagonal bipyramidal rice-like morphology have been synthesized and by inducing large amount of strain in the structure, non-cubic phases have been obtained.

A simple method to prepare turbostratic graphene was developed. Thus produced graphene is found to exhibit Raman spectra akin to single layer graphene. III-Nitride growth has been built in the past year. Defect free InN thin films and nanorods were formed by using GaN nanowall network as templates. Novel ways were found to enhance the band-edge emission from GaN nanowall networks, by morphology tuning, formation of AlN intermediate layer and deposition of Ag nanoparticles for SPR coupled emission. Some preliminary studies have been performed to assess the feasibility of using the GaN nanowall network as a gas sensor and also for water splitting by band tuning its band-gap.

A clear understanding was developed about the charge transfer dynamics in twisted perylene solar cells. The nature of phase segregation in blends of polymer and twisted perylene was studied using a ferroelectric matrix. Using these inputs, the efficiencies of perylene containing cells have been pushed further. In the area of catalysis, it was shown that sodium cations can be used to control the conformation of organo-catalysts. Additionally, a novel cyanide free synthesis of α -amino acids was developed. Studies aimed at understanding the mechanism of this reaction are currently under progress.

A new family of magnetoelectric material based on spinel structure with magnetic ions only at the A-site (AB_2O_4 where A=magnetic ions and B=nonmagnetic ions) has been discovered. The well-known spinel oxide, Co_3O_4 has also been shown to exhibit magnetoelectric properties. In this compound, Co_3+ ions at the B-site are diamagnetic and Co_2+ ions at the A-site exhibit antiferromagnetic ordering. The magnetic structure in $MnGa_2O_4$ has been confirmed to be collinear from neutron diffraction experiment.

Research has been pursued towards the development of porous functional materials like Metal-Organic Frameworks (MOFs), Covalent-Organic Frameworks (COFs), Conjugated Microporous Polymers (CMPs) and also Nanoscale Metal-Organic Materials. Efforts has been devoted to fabricate functional nanoscale coordination polymers and demonstrations were shown on higher CO_2 uptake in a nano- MOF realized by accelerated adsorption kinetics at nanoscale (*N. Sikdar et al., Inorg. Chem., 53, 5993–6002, 2014*). Nanoscale

coordination polymer of Gd(III) have been furnished for bimodal Imaging and nitroaromatic sensing (V. M. Suresh *et al.*, *J. Phys. Chem. C*, 118, 12241–12249, 2014). A flexible 3D supramolecular framework have also been synthesized that can accommodate different electron-donating aromatic amine guests with selective turn-on emission signaling and eventually serves as a molecular recognition platform through an emission-readout process (R. Haldar *et al.*, *Angew. Chem. Int. Ed.*, 126, 11966–11971, 2014). Several novel MOF composites with grapheme, SBA-15 and BN nanosheets were also furnished by where novel and enhanced functions of the composites were achieved through synergistic combination of the constituent active materials. Light harvesting by new CMPs, detail magnetic investigation of novel coordination polymers, bimodality of anionic MOF showing turn-off sensing for Cu(II) and specific sensitization of Eu(III), fabrication of porous graphene frameworks pillared by organic linkers are some other noteworthy achievements.

New Programmes launched during the year

Research activity in computational biology has been strengthened. Newer problems in this domain and in the area of weak interactions and self-assembly have been pursued.

The Atomic Layer Deposition system have been installed and calibrated and grown high quality TiO₂. As future research, plans have been structured to use GaN/TiO₂ heterostructures to study various modifications of optical and electrical properties of GaN and InN.

Preparation and study of electrical and magnetic properties of hybrid inorganic-organic materials that adopt perovskite like structure have been initiated.

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, F A Sc

K S Narayan – Ph D, F N A Sc, F A Sc, F N A

G U Kulkarni – Ph D

S M Shivaprasad – Ph D

Chandrabhas Narayana – Ph D, F N A Sc

A Sundaresan – Ph D

Associate Professors

M Eswaramoorthy – Ph D

Tapas Kumar Maji – Ph D

Faculty Fellow

Sarit S Agasti – Ph D (*Jointly with New Chemistry Unit*)

Technical Officers

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



Research Students

Ravichandran S, Gangaiah Mettela, Loukya Chowdary B, Umesha Mogera, Amritroop Achari, Dhanya R, Gopalakrishnan K, Venkata Suresh M, B. Satyanarayana, S. Kiruthika, B. Karteek Kumar, A.Z. Ashar, Tarak Karmakar, Nivedita Sikdar, Devendra Singh Negi, Arpan De, Somnath Ghara, Sunita Dey, Sreedhara M.B., Sanjay Kumar Nayak, Swathi, Papri Sutar, Dheeraj Kumar Singh, Dibyashree Chakraborti, Syamantak Roy, V. Rajaji, Rishav Harsh, Bharath B, Chaitali Sow, Sudip Das, Abhijit Chatterjee, Badri Vishal, Korlepara Divya Bharathi, Preeti Sheokand, Apoorva Singh, Nisha Mariam Mammen, Piyush Kumar Chaturbedy, Arpan Hazra, S.R.K. Chaitanya Sharma Y, Chidambar Kulkarni, Dileep Krishnan, Gayatri Kumari, M. Pandeewar, 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, Sonu K.P., Raaghesh A.V., Suchitra, Uttam Gupta, Sohini Bhattacharyya, Shantanu Aggarwal, Vikas Garg, Shivakumar D.T., Priyank Singh, Abhiroop Lahiri, Nikita Gupta, Srimayee Mukherji, Anirudha Mirmira, Pavitra Nityanand Shanbhag, Anaranya Ghorai,

Research Scientist B

Vijay Amirtharaj A, Ananda Raman

Research Associates

Sorb Y A, Satish Shetty, K D Mallikharjuna Rao, Rambabu Angalakurthi

Research Associates (Provisional)

Ravichandran Shivanna, Piyush Kumar Chaturbedy

Sr Research Officer

Jay Ghatak

Programme Coordinator

Vanitha B

Programme Assistant

K Venkatesh

Technical Assistant

N R Selvi

R&D Assistants

Rajashekhar Pujar, Kartikeya Srivastava, Sanjit Kumar Parida, Nisha Palanisamy Rajendran, Sahana S, Bhavya D R

Project Assistant (Level-II)

T Basavaraj

Lab Helper

Victor Satish

Glass blower (Temporary)

Nanda Kishore

Accounts / Assistant Trainee

Geetha Bai Venugopalan

EDUCATION TECHNOLOGY UNIT (ETU)

Activities and Achievements

The Education Technology Unit is involved in the concept, development and production of books and multimedia CD-ROM's 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.

During 2014-15, highly popular lectures/workshops for students and teachers have been conducted in different subjects like Physics, Chemistry and Biology.

Two students of the PGDSE course started their multimedia course. The students have submitted a multimedia presentation in their chosen subject (Physics).

A meeting of the resource persons was organised on May 19, 2014 to plan the teachers/students programme schedule for the year 2014-2015. The meeting was chaired by Prof C N R Rao. At the meeting, it was planned that two lecture programs each in Physics, Chemistry and Biology; two programs in Chemistry jointly with New Chemistry Unit (one for X class students and one for Classes XI & XII) will be organised. It was also suggested that a lecture program exclusively for girl students with lectures delivered by Women Scientists/lecturers be organised. It was proposed to have lecture programs for Jawahar Navodaya Vidyalaya and Kendriya Vidyalaya students. 'Nano Day' for students and teachers was also proposed.

The Unit was assigned the task of producing the print-ready copy of the book titled 'New forms of Carbon (Nanocarbons)' by Prof C N R Rao. The layout was designed and the graphics/visuals were completed for the book. The formatting of the book was completed in-house and the print-ready copy of the book was sent to the National Book Trust for printing.

The Unit had taken up the task of producing the book 'Pioneers in Chemistry' by Prof C N R Rao and Mrs Indumati Rao. The Manuscript was prepared for editing and the corrections and suggestions were incorporated. The Unit has taken up the task of formatting the book.

The C N R 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.

Several lectures delivered by Prof C N R Rao were transcribed to bring these out in the form of a booklet. Work is in progress.

The Karnataka State Women's University, Vijayapura conferred the Honorary Doctorate in Literature on Mrs Indumati Rao in recognition of her contributions for the cause of Popularizing Science Education at a function held on 3 March 2015.

Organisation of Programmes

The Summer 2014 Science Outreach Programme sponsored by the C N R Rao Hall of Science, JNCASR was conducted in association with Himalayan Gram Vikas Samiti, Gangolihat by Prof K S Valdiya during April 19-25, 2014. A 30-minute multimedia presentation in Hindi was presented. Excerpts from the CD-ROM title "Understanding Chemistry" were translated into Hindi and the text was made into bitmap images for incorporation into the presentation. Mrs Indumati Rao presented the multimedia presentation. A powerpoint presentation was also prepared on 'Rasayan Vigyan Manana' with both Hindi and English subtitles for Prof. CNR Rao's lecture to students and teachers. Prof. Rao gave the lecture titled 'Nanoworld'. On 24th April, at the



CSIR-Indian Institute of Petroleum, Dehradun, Prof Rao gave the lecture titled 'Celebration of Science'.

On May 20 and 21, 2014, a one-hour multimedia presentation was presented each of the CD-ROM 'Nanoworld' and excerpts from the CD-ROM 'Understanding Chemistry' to the POCE students.

Eight lecture programs were conducted during 2014 for students and teachers. In addition to the planned programs, a program for INSPIRE students was conducted.

The teachers-students programs/workshops was conducted under the auspices of the Science Outreach Program for 2014 on June 30, 2014. 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 2013 prizes for Outstanding Science Teachers were Shri. Narayan Vitthalrao Babanagar and Dr. Shripal Rathi. The Lecture Program had one lecture in Chemistry and one in Biology. The titles of the lectures were: New forms of Carbon (Nanocarbons) by Prof. CNR Rao; Evolution of Human Cognition by Prof. L.S. Shashidhara (IISER-Pune). Around 230 students and teachers attended the program.

Following are the other programmes / workshops organised by the CNR Rao Hall of Science and ETU at the Madan Mohan Malaviya Amphitheatre:

30 June 2014 – Lecture Program (Science Teacher Award Function)

17 July 2014– Program in Physics for students

22 August 2014 – Program in Biology for students

22 September 2014 – Program in Chemistry for students (Jointly organized with NCU)

12 November 2014 – Program in Chemistry for students (Jointly organized with NCU)

4 December 2014 – Program in Chemistry

16 December 2014 – Program in Biology for students

26 December 2014 – Inspire Program

In each of the above programs, over 200 students and teachers participated. All the above programs consisted of lectures and some demonstrations followed by an interactive question and answer session. All the above programs were organized under the auspices of the Science Outreach Program.

A program with New Chemistry Unit was organised in September 2014 for students and teachers of XI and XII classes. The program in chemistry was a full-day program. It started with a tribute to Michael Faraday with the screening of a short film followed by a lecture by Mrs Indumati Rao to commemorate his 223rd birthday. This was followed by a lecture titled 'Structure drives Chemistry' by Shri. H.R. Madhusudan (Jawaharlal Nehru Planetarium, Bangalore). This was followed by a chemistry quiz where all the colleges had their teams participating in it. In the afternoon, the participants visited the Chemistry of Materials Exposition & Prof C N R Rao Archives and a video of the Innovative Chemistry Experiments conducted by NCU students and Faculty members was screened. In the concluding session, Mrs Indumati Rao gave away the Ist and IInd prizes to the winning team members of the Quiz competition. Around 200 students and teachers participated in the program.

In the month of November 2014, a full-day programme for Class X students was conducted. The program had a lecture by Dr Jayanta Haldar followed by the screening of a short film 'Getting to know the Scientists', a chemistry quiz and experiments in chemistry for the students by NCU faculty members. The program was highly successful. 200 students and teachers attended the program.

A 'Program in chemistry' was organized on 4 December 2014 where Prof Bert Meijer and Prof C N R Rao gave lectures followed by a multimedia presentation of excerpts from the CD-ROM title 'NANOWORLD'.

'INSPIRE Program' was organised on 26 December 2014 for the students participating in INSPIRE camp. The program had lectures in chemistry with a tour of some laboratories in JNCASR.

On 31 October 2014, a program for students and teachers was organized at Trivandrum where Prof C N R Rao gave the lecture 'New forms of Carbon (Nanocarbons)' followed by a multimedia presentation by Mrs Indumati Rao. Excerpts from the CD-ROM title Nanoworld' were presented. 300 students and teachers participated in the program and the book and CD-ROM titled 'NANOWORLD: an introduction to nanoscience and technology' was distributed to the participating schools.

A workshop for doing experiments using the College Chemistry kit was organized by SOP-POCE on January 12, 2015. Mrs Rao gave the lecture on 'Michael Faraday'.

On February 11, 2015, at a program organized for students and teachers at the Vivekananda Global University, Jaipur, Prof. CNR Rao gave the lecture titled 'NANOWORLD' and Mrs Indumati Rao presented multimedia presentation of excerpts from the CD-ROM 'Nanoworld'.

On February 23, 2015 Prof. C.N.R. Rao delivered the lecture 'A Celebration of Chemistry' to students and teachers at the Ras Al Khaimah Center for Advanced Materials. Mrs. Indumati Rao presented excerpts from the multimedia CD-ROM 'NANOWORLD'. On March 19, 2015 a lecture programme was organised for students and teachers in Jorhat.

Following are the members of this Unit:

Chair

Prof V Krishnan – Ph D, F A Sc, F N A, F T W A S

Co-ordinator (Hon)

Indumati Rao – Ph D (Hon. Causa), M A, M S, C E

Sr Technical Officer

Jatinder Kaur – M Sc

Assistant (Multimedia)

Sanjay Rao – B Sc, Cert. Multimedia



ENGINEERING MECHANICS UNIT (EMU)

During the year 2014-2015, activities in the Engineering Mechanics Unit include study of convection and instabilities in vibrated granular bed, fluid exchange between chambers having different density fluids through vertical and horizontal openings, shock-waves in dilute granular gases, development of an improved algorithm based on delayed difference scheme for large scale scientific simulations, implementation of lattice scheme for three-dimensional multiphase simulations with high density ratios.

Close comparison between flow fields and LBM-based 3-D simulations of flapping flight have been obtained in experiments. Experimental studies also showed the importance of accounting for three-dimensional nature of the flow and variation in lift produced for rigid and flexible wings during flapping. Experimental study on drag-reducing polymer (DRP) indicated occurrence of delayed transition, shift of instability to a longer wavelengths in the DRP solution compared to that for plain-water.

Particle-level simulations, with a rigorous accounting for hydrodynamic interactions, were used to examine the nature of correlations and fluctuations in microscopic swimmer suspensions.

Considerable progress has been made during the year on DNS studies of the flow past a low pressure turbine blade. A very high resolution (190 million grids) direct Navier Stokes computer simulation has provided for the first time pressure distributions on the blade that are very close to measured values. Many other interesting aspects of the flow, revealed by the simulation, were analyzed in detail. The novel low drag wing planforms for turbo-prop aircraft, obtained by using optimization techniques, has now received patents from US, South Korea, and Japan.

Following are the members of the Unit:

Chair

K R Sreenivas – Ph D

Honorary Professor / DST Year-of-Science Professor

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

Professors

K R Sreenivas – Ph D

Meheboob Alam – Ph D

Associate Professors

Ganesh Subramanian – Ph D

Santosh Ansumali – Ph D

Research Students

Achal Mahajan, Jumpal Shashikiran Reddy, K. Siddharth, Lakshminarayana Reddy M.H, Mahan Raj Banerjee, Manjusha Namburi N L D B, Mohammad Raifuddin, Mohammed Istafaul Haque Ansari, Nakul Pande, Navaneeth K M, Praveen Kumar K, Rajesh Ranjan, Rama krishna Rongali, Ronak Gupta, Saikat Saha, Saikishan Suryanarayanan, Samarth Agrawal, Sankalp Nambiar, Shashank H J, Sunil V Bharadwaj, Ujjayan Paul, Vybhav G R

NBHM- Post Doctoral Fellow

Shailendra Kumar Singh

Research Associates

Ponnulakshmi V K, Nandu Gopan, Tirthankar Sengupta, Sachin Yashavant Shinde,
Samrat Rao, Aarthi Sekaran

R&D Assistants

Chakradhar Thantanapally, Milind Prakash Dhake, Unnikrishnan P K, Arun Kumar V,
Kanwar Nain Singh

Secretarial Assistant Trainees

H V Vijaylakshmi, Gayathri J.S.



EVOLUTIONARY AND ORGANISMAL BIOLOGY UNIT (EOBU)

During the year 2014-2015, the faculty of EOBU continued to conduct research in the broad areas of animal behavior, phylogeography, chronobiology, evolutionary genetics, neurogenetics, neurodegenerative disorders, 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) philosophical clarifications of the usage of the terms fitness and inheritance, (m) life history evolution, (n) evolution of circadian rhythms, (o) adaptive significance of circadian rhythms, (p) neurogenetic basis of circadian egg-laying rhythm in fruit flies, (q) connection between circadian clocks and life history traits, (r) molecular-genetic regulation of morning and evening chronotypes, (s) role of social cues in circadian timing, (t) sleep-enrichment in fruit flies, 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 Project Oriented Biology Education (POBE) and Summer Research Fellowship programme (SRFP) of the Centre as well as similar outreach programmes run by the three Indian Science Academies and by DST and KVPY.

Research Progress

1. It has been shown that not only density (eggs per unit volume of food) but also the total height of the food column in *Drosophila* culture vials affects the nature of selection in crowded cultures and potentially leads to the evolution of competitive ability via different sets of traits.
2. The breeding ecology of *Drosophila* populations selected for rapid development and early reproduction is very different from controls, including much lower levels of remating by females. This shows the action of sexual selection on these populations as a by-product of the maintenance regime being used to select for rapid development and early reproduction.
3. New methodology for assaying larval feeding rate in conditions approximating *Drosophila* culture vials is being developed.
4. The formal relationship between ecological (rate of reproduction) and evolutionary (rate of increase) fitness was investigated theoretically.
5. The phenomenon of inheritance was investigated formally and it is shown that inheritance is used for phenomena in a way that confounds cause and effect. New terminology is being proposed to eliminate this confusion.
6. Work on the social structure of female Asian elephants was continued in Nagarahole and Bandipur National Parks. It was found that, unlike African savannah elephants, female social groups in this study population were very rigid in their clan structure and did not associate with females across clans. Again, unlike African savannah elephants, there was no hierarchy of social organization within clans.
7. Work on dominance between female social groups showed high levels of dominance between clans but no linear dominance hierarchy. Whether resources around the Kabini reservoir affect these dominance relationships is being examined currently.
8. Examination of sex ratios in the Kabini area through mark-recapture sampling and individual

identification revealed large fluctuations in monthly sex ratios during the dry season, which has implications for the validity of yearly censuses.

9. A simulation-based study of mark-recapture methods to assess elephant population size showed that social structure had a minor effect on bias in population size estimation while trapping scenarios could have large effects on bias.
10. Playback experiments carried out on mynas showed that although myna roosts were not recruitment centres, mynas could be induced to roost at an abandoned roost site through conspecific calls.
11. Studies of the interaction between the circadian and homeostatic control of sleep in the model system *Drosophila melanogaster* reveals that one set of arousal neurons (large ventral lateral neurons) send inhibitory signals via the neurotransmitter PDF to another structure (the dorsal fan shaped body) which has been previously suggested to induce sleep.
12. By targeting a relatively small neuronal circuit in the fruitfly brain it was found that it is possible to delay the onset of neurodegeneration by temperature cycles given during early developmental stages. Further it was shown that upregulation of heat-shock proteins can also give a similar rescue. Another study revealed that upregulation of autophagy gene atg8a can also delay the onset of neurodegeneration.
13. Visual observation of behavioural rhythms of two closely related and sympatric insect species *D. melanogaster* and *D. ananassae* confirmed the differences which were previously obtained using an automated activity recording monitor, thus verifying that the observed differences in activity were not artifact.
14. It was reported that opposite effects of a thermosensory ion channel on rhythmic behaviour of *D. melanogaster* depending on whether the temperature was gated or changing gradually.
15. An assay protocol was developed to determine whether activity rhythms can be synchronised to cyclic food availability.
16. Extent of mismatch between the period of circadian clocks and light / dark cycles determines time-to-emergence in fruit flies.
17. Effects of polygamy on the activity / rest rhythm of male fruit flies *Drosophila melanogaster*.
18. Fly populations selected for evening adult emergence exhibit delayed pupation and development times, higher fecundity, and reduced adult lifespan.
19. Fly populations selected for evening adult emergence evolve circadian clocks composed of weak oscillators.
20. Fly populations selected for evening adult emergence evolve circadian clocks with greater developmental plasticity.
21. Pair-wise social interaction in males results in clock-independent sleep-enrichment in fruit flies *D. melanogaster*.
22. Or47b olfactory sensory neurons regulate male-mating success in fruit flies *D. melanogaster*.
23. Mechanosensory signals act via chordotonal organs to promote sleep in fruit flies *D. melanogaster*.
24. Circadian clocks partly regulation life history traits in fruit flies *D. melanogaster*.
25. Selection for narrow gate of emergence results in correlated sex-specific changes in life history of *Drosophila melanogaster*.
26. Breakdown of selection-mediated correlation between development time and clock period.



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27. Correlated changes in life history traits in response to selection for faster pre-adult development in fruit flies *Drosophila melanogaster*.
 28. Circadian clocks of faster developing fruit fly populations also age faster.
 29. Interaction of light regimes and circadian clocks modulate timing of pre-adult developmental events in *Drosophila*.
 30. Rhythmic egg-laying behaviour in virgin females of fruit flies *Drosophila melanogaster*.
 31. Role of temperature in mediating morning and evening emergence chronotypes in fruit flies *Drosophila melanogaster*.

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

Vidyanand Nanjundiah – Ph D, F A Sc, F N A

Faculty Fellow

T N C Vidya – Ph D

Associate Faculty from Neuroscience Unit

Sheeba Vasu

Research Students

Abhilash Lakshman, Antara Das, Anuj Menon, Avani Mital, D Swathi, Goirik Gupta, Hansraj Gautam, Iyengar Aishwariya Prasan, K Ratna, Keerthipriya P., Kulkarni Rutvij Kaustubh, Manan Gupta, Manaswini Sarangi, Manishi Srivastava, Nandini R Shetty, Neha Pandey, Nikhil K. L., Pavitra Prakash, Payel Ganguly, Pritha Kundu, Radhika Dilip Shindey, Rashmi Vinayak Savant, Shambhavi Chidambaram, Sheetal Potdar, Singh Viveka Jagdish, Srikant Venkitachalam, Vishwanath Varma

Research Associate

Joy Bose

R&D Assistants

Sajith V S, Shruti Mallya, Revathi Ramdas

GEODYNAMICS UNIT (GDU)

ACTIVITIES AND ACHIEVEMENTS

During the reporting period, research work was undertaken towards understanding the earthquake mechanisms, post-seismic processes and plate deformation along the Andaman-Nicobar subduction zone using geological, seismological and GPS data. Substantial work has also been conducted to understand the earthquake hazard in the central Himalaya. Further, new proposals have also been formulated on seismic hazards and also climatic evolution in India.

Earthquake / tsunami recurrence studies (Andaman Islands): A major program was started to develop a robust chronological database on the Indian Ocean tsunami history from deep coring in the area that was subsided in 2004 near Port Blair. The cores are expected to preserve bands of tsunami depositions alternating with regular cycles of tidal sedimentation. This is the first attempt to generate a continuous record of tsunami/earthquake recurrence in the Indian Ocean. Until now the evidence for past tsunamis were drawn from land records from Andaman using analogy with the tsunami in 2004. These analogs included subsided mangrove swamps, uplifted coral terraces, liquefaction, and organic soils coated by sand and coral rubble. But the land records may not contain the continuous evidence as they are prone to erosion. The current work is focused on obtaining the cores from the depositional environments of tidal inlets and estuaries of the Andaman region. The data is expected to give a continuous record of tsunamis and will be the key input for the tsunami hazard models of the region. Work on analyzing cores (~10-m-long) from three locations near Port Blair is in progress. The process of generating radiocarbon dates of different depth levels within the cores along with characterizing them geochemically and also by their faunal content is also in progress.

Crustal deformation studies (Andaman Islands): Studies in this area revealed that more than ten years after the great (Mw 9.2) Sumatra-Andaman earthquake, the Global Positioning System (GPS)-based displacements in the Andaman and Nicobar Islands indicated that early near-field motions were dominated by slip down-dip of the rupture. After subtracting a pre-2004 interseismic velocity, significant transient motion during the 2008.5–2010.5 epoch confirms that postseismic relaxation processes continue in Andaman. Both deep slip and flow respond to stress changes, and each can significantly change stress in the realm of the other; it therefore is reasonable to expect that both transient deep slip and viscoelastic flow will influence surface deformation long after a great earthquake.

Earthquake studies (Andaman-Nicobar subduction zone): The 1300-km-long rupture zone of the 2004 Andaman–Sumatra megathrust earthquake continues to generate a mix of thrust, normal, and strike-slip faulting events. The 12 June 2010 Mw 7.5 event on the subducting plate is the most recent large earthquake on the Nicobar segment. The left-lateral faulting mechanism of this event is unusual for the outer-rise region, considering the stress transfer processes that follow great underthrusting earthquakes. Another earthquake (Mw 7.2) with a similar mechanism occurred very close to this event on 24 July 2005. These earthquakes and most of their aftershocks on the subducting plate were generated by left-lateral strike-slip faulting on the NNE-SSW oriented near-vertical faults, in response to NNW-SSE directed compression. Pre-2004 earthquake faulting mechanisms on the subducting oceanic plate are consistent with this pattern. Post-2004, left-lateral faulting on the subducting oceanic plate clusters between 5° N and 9° N, where the 90° E ridge impinges the trench axis. Researchers of this Unit observed that the subducting plate off the Sumatra and Nicobar segments can be considered as a chip of the India–Australia plate, deforming in response to a generally northwest-southeast oriented compression, an aspect that must be factored into the plate deformation models.

Earthquake recurrence in the central Himalaya: Studies were conducted along the Himalaya to understand the earthquake recurrence pattern. The study addresses the problems like whether the great earthquakes follow any



kind of a spatial or temporal clustering or in quasi-periodical fashion by directly studying the fault exposures and also by analyzing proxies like liquefaction features generated by ground accelerations due to past earthquakes sourced in the Himalaya. The studies suggest spatio-temporal clustering of great earthquakes in the medieval times in the central Himalaya and this segment appears to be mature to generate a great earthquake. The caves were explored for damaged stalagmites to characterize earthquake induced damage and develop a chronology of deformations identified on them. An age data of earthquake induced liquefaction features within the flood plains of Bihar and eastern Uttar Pradesh were generated and are in the stage of consolidating the results.

New programs launched during the year

1. A project entitled “Holocene Climate Changes and Tracking the Impact of Anthropogenic Activity in Wular Lake in Kashmir Himalaya: Appraisal of Human Influence” has been initiated under Science & Engineering Research Board (SERB) Fast Track Proposals for Young Scientists (PI: Jaishri S. Bhatt).
2. A new collaborative initiative was formulated on “Seismic hazard in NE India” under the theme on seismic hazards, a joint multi-institutional Indo-Norway collaboration in geosciences as part of the understanding of ESSO-MoES with Research Council of Norway for cooperation and coordination of activities and programs in the field of Earth System Sciences (PI from JNCASR: C. P. Rajendran).

Following are the members of this:

Chair

K S Valdiya – FASc, FNA, FNASc, FTWAS

Senior Associate

C P Rajendran – Ph D

Principal Investigator

Jaishri Sanwal Bhatt – Ph D

MOLECULAR BIOLOGY AND GENETICS UNIT (MBGU)

Prof Namita Surolia

Research activities during 2014 were focused on molecular mechanisms underlying cerebral malaria pathogenesis; functional characterization of *Plasmodium falciparum* centromeric proteins CENP-A and CENP-C; role of autophagy in *Plasmodium falciparum*.

A protein-protein interaction network using 'Systems' approach was created on global gene expression profile from parasite RNA isolated from peripheral blood samples of patients suffering from severe non-cerebral and cerebral malaria. From the large network, two of the pathways involving a Host-pathogen interactions and b. vesicular trafficking were further validated using immune-precipitation and RTPCR studies. From these studies very interesting findings have emerged; one of them being that ETRAMP 14.1, one of the early transcribed membrane protein family member, interacts with the major virulent *Plasmodium falciparum* protein, the PfEMP1 and other members of parasite translocon machinery leading to speculate that ETRAMP14.1 might be facilitating trafficking of PfEMP1 to host surface.

Both the centromeric proteins PfCENPA and PfCENPC from this parasites were functionally characterized, by complementation assays. These studies are first of its kind as no experimental studies on centromeric proteins from this important parasites have been carried out till date.

For understanding role of autophagy in *P.falciparum*, which is undefined, two major autophagy proteins, the PfAtg8 and the putative PfAtg8 were characterized.

HIV-AIDS Laboratory

During the past year, the HIV-AIDS laboratory examined the proviral DNA load in nine different brain regions and three different peripheral tissues derived from ten human subjects at autopsy. Uniform proviral distribution among the brain compartments identified and examined without preferential accumulation of the DNA in any one of them. The overall viral DNA burden in the brain tissues was very low, approximately 1 viral integration per 1000 cells or less. In a subset of the tissue samples tested, the HIV DNA mostly existed in a free unintegrated form. In a follow up study examining the stabilized clinical profile of the study subjects administered a polyherbal formulation as a potential HIV-AIDS therapeutic strategy, identified at least 5 immune markers all suggesting attenuated immune activation in the PHF arm suggesting that regulating immune activation could be a potential disease management strategy in HIV-AIDS.

Vascular Biology Laboratory

A novel mechanism for maintenance of stem cell potency by endosomal regulation was proven. Several *Drosophila* models of leukemia were generated. Knockout mice for the endosomal protein Asrij has been identified and showed that mice lacking Asrij develop a blood cell disorder. Hence, a novel model for studying human hematopoietic disorders has been developed. It was found that human embryonic stem cell differentiation is regulated by Asrij.

Currently, the group is genetically manipulating human embryonic stem cells to generate overexpression and knockdown lines of genes of interest. These modulated cell lines are being tested in cardiovascular differentiation.

Chromatin Biology Laboratory

Histones regulate a variety of chromatin templated events by their post-translational modifications (PTMs). Although there are extensive reports on the PTMs of canonical histones, the information on the histone variants remains very scanty. The identification of different PTMs were reported, such as acetylation, methylation,



and phosphorylation of a major mammalian histone variant TH2B. Mass spectrometric analysis has led to the identification of both conserved and unique modifications across tetraploid spermatocytes and haploid spermatids. The 3-dimensional model of a TH2B has been computationally derived containing nucleosome in order to study the spatial orientation of the PTMs identified and their effect on nucleosome stability and DNA binding potential. From this nucleosome model, it is evident that substitution of specific amino acid residues in TH2B results in both differential histone–DNA and histone–histone contacts. Furthermore, it was also observed that acetylation on the N-terminal tail of TH2B weakens the interactions with the DNA. These results provide direct evidence that, similar to somatic H2B, the testis specific histone TH2B also undergoes multiple PTMs, suggesting the possibility of chromatin regulation by such covalent modifications in mammalian male germ cells.

Mrhl RNA is a nuclear lncRNA encoded in the mouse genome and negatively regulates Wnt signaling in spermatogonial cells through p68/Ddx5 RNA helicase. Mrhl RNA is present in the chromatin fraction of mouse spermatogonial Gc1-Spg cells and genome wide chromatin occupancy of mrhl RNA by ChOP (Chromatin oligo affinity precipitation) technique identified 1370 statistically significant genomic loci. Among these, genes at 37 genomic loci also showed altered expression pattern upon mrhl RNA down regulation which are referred to as GRPAM (Genes Regulated by Physical Association of Mrhl RNA). p68 interacted with mrhl RNA in chromatin at these GRPAM loci. p68 silencing drastically reduced mrhl RNA occupancy at 27 GRPAM loci and also perturbed the expression of GRPAM suggesting a role for p68 mediated mrhl RNA occupancy in regulating GRPAM expression. Wnt3a ligand treatment of Gc1-Spg cells down regulated mrhl RNA expression and also perturbed expression of these 27 GRPAM genes that included genes regulating Wnt signaling pathway and spermatogenesis, one of them being Sox8, a developmentally important transcription factor. Interacting proteins of mrhl RNA associated chromatin fraction which included Pc4, a chromatin organizer protein and hnRNP A/B and hnRNP A2/B1 was also identified which have been shown to be associated with lincRNA-Cox2 function in gene regulation. The findings of the study in the Gc1-Spg cell line also correlate with the results from analysis of mouse testicular tissue which further highlights the in-vivo physiological significance of mrhl RNA in the context of gene regulation during mammalian spermatogenesis.

In a unique global chromatin remodeling process during mammalian spermiogenesis, 90% of the nucleosomal histones are replaced by testis-specific transition proteins, TP1, TP2, and TP4. These proteins are further substituted by sperm-specific protamines, P1 and P2, to form a highly condensed sperm chromatin. In spermatozoa, a small proportion of chromatin, which ranges from 1 to 10% in mammals, retains the nucleosomal architecture and is implicated to play a role in trans-generational inheritance. However, there is still no mechanistic understanding of the interaction of chromatin machinery with histones and transition proteins, which facilitate this selective histone replacement from chromatin. The identification of 16 and 19 novel post-translational modifications on rat endogenous transition proteins, TP1 and TP2, respectively, by mass spectrometry was reported. By in-vitro assays and mutational analysis, protein-arginine methyltransferase PRMT4 (CARM1) methylates TP2 at Arg71, Arg75, and Arg92 residues, and lysine methyltransferase KMT7 (Set9) methylates TP2 at Lys88 and Lys91 residues were demonstrated. Further studies with modification-specific antibodies that recognize TP2K88me1 and TP2R92me1 modifications showed that they appear in elongating to condensing spermatids and are predominantly associated with the chromatin-bound TP2. This work establishes the repertoire of post-translational modifications that occur on TP1 and TP2, which may play a significant role in various chromatin templated events during spermiogenesis and in the establishment of the sperm epigenome.

Autophagy Laboratory

Current ongoing research looks at multiple aspects of autophagy biology using yeast, mammalian cells and mouse models. The laboratory has identified small molecules that regulate autophagy in both yeast and mammalian systems. To identify these small molecules, a high throughput screening of several libraries consisting of

~200,000 compounds was screened at UCLA using an in-house developed real time autophagy assay. Follow-up work on some these compounds has identified compounds that upregulate autophagy and the recent results show that one of the compound promotes autophagic elimination of Salmonella in an infection model. Another potent autophagy inducer helps clear neuronal protein aggregates via autophagy and has provided promising results in a mouse model of Parkinsonism. Three of the autophagy inhibitors identified in the laboratory have shown to affect the various stages of the autophagosome vesicle itinerary. Finally, detailed characterization of the roles of two novel protein complexes in autophagy is nearing completion.

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 Distinguished Fellow Honorary Professor

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

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Ashvini Ray, Jasper Chrysolite Paul, Venkata Anudeep, Kaustub Kalamkar, Anitha Sanjay
Rokhade, Sourav Nayak, Lakshmi Kumari R, Chetan D R, Surabhi Sudevan, Shilpa Patil

Secretarial Assistant Trainees

Nandini N, Lavanya M

NEUROSCIENCE UNIT (NSU)

Neurooncology

Aebp1 is a transcription factor involved in adipogenesis. In a transcriptome analysis of graded patient glioma samples, it was discovered as one of the genes to be up regulated in majority of the primary GBM. On probing the role of Aebp1 over expression in glioblastoma, it was found that both cellular proliferation and survival were affected on Aebp1 silencing of glioma cells, resulting in cell death. A detailed analysis was carried out to understand the mechanism of cell death and shown that it is by a caspase independent mechanism called Parthanatos. Aebp1 downregulated U138MG glioma cells were probed for caspases with or without the presence of Pan Caspase inhibitor to check for their activation. PARP-1 activation was assessed by measuring PAR polymer formation. Loss of MOMP was assessed through Mitotracker using Flowcytometry and Immunofluorescence. Release of AIF was assessed through Immunofluorescence, subcellular fractionation and Immunoprecipitation. Luciferase promoter assay and CHIP-PCR showed PI3K β regulation by Aebp1. PI3K β down regulation and translocation was shown through western analysis and immunofluorescence. It was discovered that the initial signal for cell death is triggered by the depletion of Aebp1 that positively regulates PI3Kinase CB, by the binding of Aebp1 to the AE-1 binding element in PI3KinaseCB promoter. PI3Kinase CB is known to act as DNA damage sensor in the nucleus along with Nbs1-Mre11 complex. Loss of PI3Kinase β leads excessive DNA damage and activation of Parp1. Subsequently, AIF is released from the mitochondria due to loss of mitochondrial outer membrane potential and it translocates to the nucleus causing chromatinolysis. This mechanism of cell death is caspase independent and called Parthanatos. Aebp1 down regulation leads to decreased expression of PI3Kinase CB resulting in an enhancement of the pre existing DSBs in U138MG glioma cells thus resulting in chromatinolysis generating large scale DNA fragmentation of approximately 50Kb and cell death through the mechanism called Parthanatos.

Cellular mechanisms of human mind disorders

A cardinal feature of human brain development is that sensory, cognitive and emotional experiences shape synapses and neural-circuit development. Neuronal activity triggers changes at the synapse, altering the composition, shape and strength of the synapse. These neuronal activity-dependent modifications are necessary for learning and memory and for various behavioural responses, particularly during development. Several studies have shown that these features are altered in Intellectual Disability (ID) and Autism Spectrum Disorder (ASD), which affects ~3-4% of the population in the world. Mutations that cause ID and ASD are increasingly found in genes that encode for proteins that regulate synaptic function and/or structure. Recently, a de novo heterozygous (het) mutations in the gene that encodes for synaptic RasGAP, SynGAP1, has been shown to cause ID and increase the risk for developing ASD in young children. Recently, it was demonstrated that in syngap1 heterozygous Knock-out (Het) mice, the net effect of syngap1 haploinsufficiency was to unleash dendritic spine synapse in the neonatal hippocampus during development, which drives excitatory/inhibitory (E/I) imbalance, seizures and various behavioural deficits. These early dendritic synaptic spine maturation is also linked to altered duration of critical period of plasticity that leads to life-long cognitive and social deficits. Therefore, in the coming year 2015-16, plans are there to study how altered maturation in excitatory neurons in Syngap1 affects inhibitory neuronal maturation. Further studies will be conducted on how learning and memory are affected in Syngap1 mutants due to lack of coordinated activities between hippocampal and medial prefrontal cortex.

Neurogenetics and Behaviour

Studies of the interaction between the circadian and homeostatic control of sleep in the model system *Drosophila melanogaster* reveals that one set of arousal neurons (large ventral lateral neurons) send inhibitory signals via the



neurotransmitter PDF to another structure (the dorsal fan shaped body) which has been previously suggested to induce sleep. By targeting a relatively small neuronal circuit in the fruitfly brain, it was found that the onset of neurodegeneration may be delayed by temperature cycles given during early developmental stages. Further, upregulation of heat-shock proteins were shown which can also give a similar rescue. Another study revealed that upregulation of autophagy gene *atg8a* can also delay the onset of neurodegeneration. Visual observation of behavioural rhythms of two closely related and sympatric insect species *D. melanogaster* and *D. ananassae* confirmed the differences which were previously obtained using an automated activity recording monitor, thus verifying that the observed differences in activity were not artifact. Opposite effects of a thermosensory ion channel on rhythmic behaviour of *D. melanogaster* have been reported depending on whether the temperature was gated or changing gradually. An assay protocol was developed to determine whether activity rhythms can be synchronised to cyclic food availability.

Cellular and electrophysiological studies on CASR, a causative gene for genetic generalized epilepsies

Epilepsy is a relatively common brain disorder defined by recurrent and unprovoked seizures. Genetic generalized epilepsies (GGE) account for ~50% of all epilepsies and have substantially complex genetic basis to their etiology (ILAE Consortium on Complex Epilepsies, *Lancet Neurol* 13, 2014; Thomas and Berkovic, *Nat Rev Neurol* 10, 2014). In a previous study, identification of a novel genetic locus, EIG8 for GGE at 3q13-q21 (Kapoor et al, *Ann Neurol* 64, 2008) was reported. To identify the causative gene at EIG8, Detailed genetic studies were conducted revealing six mutations in the CASR gene, present exclusively among GGE/JME patients. CASR encodes a G-protein coupled receptor that senses extracellular calcium levels (Brown et al, *Nature* 366, 1993). It plays a pivotal role in maintenance of systemic calcium homeostasis and is known to regulate several cell- and tissue-specific cellular processes by modulating different intracellular signaling pathways. The six mutations identified are rare and missense changes altering highly conserved CASR residues: p.Glu354Ala, p.Asp433His, p.Ser580Asn, p.Ile686Val, p.Arg898Gln and p.Ala988Val. First line of functional analysis have been carried out comprising a (i) MAPK (mitogen-activated protein kinase) assay and (ii) Inositol monophosphate (IP1) accumulation assay, for the six CASR mutations identified.

In the MAPK assay, across different Ca²⁺ concentrations, the signaling activity of CASR followed a sigmoidal dose-response curve, with exponentially increasing activity at 3-6 mM of Ca²⁺ and saturation at higher calcium levels. The wild-type CASR- transfected HEK293T cells show a half-maximal response (EC₅₀) at 4.31 ± 0.13 mM. The signaling activities by all mutant receptors exhibit a leftward shift in the dose-response curves with EC₅₀ values of p.Glu354Ala: 3.76±0.33mM, p.Asp433His: 4.29±0.1 mM, p.Ser580Asn: 3.87±0.15 mM, p.Ile686Val: 3.52 ± 0.35 mM, p.Arg898Gln: 3.72 ± 0.27 mM, p.Ala988Val: 3.44±0.5 mM. The empty vector (pcDNA3.1) and a control vector (CASR-Asn583X pcDNA3.1) transfected cells exhibit basal level activity in response to increasing extracellular Ca²⁺ concentrations. The leftward shifts in the dose-response curves of the mutant CASR receptors suggest that these receptors have enhanced responsiveness to the Ca²⁺. Further, the effect of six CASR mutant receptors on Phospholipase C (PLC) coupled Inositol 1,4,5-trisphosphate (IP₃) pathway in response to extracellular Ca²⁺ was examined by measuring intracellular IP₁ accumulation by ELISA-based assays. As the lifetime of IP₃ is less than 30 seconds in the cell, the levels of IP₁ were quantified by competitive ELISA in presence of LiCl which prevents conversion of IP₁ to Myo-inositol. In this functional assay, the wild-type CASR transiently expressed in HEK293T cells generated a sigmoidal dose-response curve for increasing Ca²⁺ concentrations with an EC₅₀ of 4.05±0.13 mM. The dose-response curves of the mutant receptors exhibited EC₅₀ values lower than that of wild-type receptor, indicative of their activating nature (p.Glu354Ala: 3.25±0.18mM, p.Asp433His: 3.78±0.16mM, p.Ser580Asn: 3.38±0.16 mM, p.Ile686Val: 3.79±0.2mM, p.Arg898Gln: 3.05±0.18mM, p.Ala988Val: 3.42±0.23 mM). The signaling response curves for p.Glu354Ala, p.Ser580Asn, p.Arg898Gln and p.Ala988Val showed distinct leftward shift and saturation at lower Ca²⁺ concentration as compared to WT-CASR. However, the cells transfected with control vectors (pcDNA3.1 and CASR-Asn583X pcDNA) had no change in intracellular IP₁ levels due to increasing calcium concentration. The p.Arg898Gln mutation exhibited significantly high response at 3mM and 4mM Ca²⁺ concentrations than

wild-type protein. The HEK293T cells transfected with p.Ala988Val mutant receptor showed significantly reduced intracellular IP1 levels than wild-type at 5mM Ca²⁺, exhibiting saturation at lower calcium levels. Quite similar to their effect on MAPK pathway, these mutant receptors show activation at Ca²⁺ concentrations lower than that of wild-type CASR, in the PLC-IP₃- mediated signaling pathway. Based on these observations, it was proposed that these activating variants affect the CASR-regulated neuronal functions in a manner which remains to be deciphered. The function of CASR in the brain is believed to be crucial to maintain normal neuronal excitability and that CASR is a potential therapeutic target in epilepsies. Future research on CASR may include examining effect of mutant CASR on receptor trafficking to the plasma membrane, determining the calcium affinities and examining electrophysiological properties of the epilepsy-associated mutations identified.

Biomaterials for interfacing sensory organs

The possibility of seamlessly integrating sense organs with device components and circuits consisting of soft electronic materials on biocompatible substrates offers useful options to monitor-enhance-augment natural response to various stimuli. In this regard, semiconducting polymers form a promising material system which offers a unique combination of optoelectronic and mechanical properties: namely for features related to mechanical conformity, large visible light absorption strength which results in sizable density of photogenerated carriers and solution processability. It has been observed generally that polymer surfaces with appropriate mechanical attributes such as adhesive strength, microtexture and nanotopography, surface wettability and stiffness are conducive for anchoring neuronal cells. The electronic characteristics of certain conjugated polymers have also been used for sensing and stimulating neuronal activity. The optoelectronic properties of these materials have recently been utilized as active triggers for neuronal stimulation. For instance, the availability of synthetic soft polymer substrates, which mechanically mimic the in vivo conditions, has helped in rapid advances in the field of tissue engineering. The use of these novel optoelectronic features of organic semiconductor based polymer layers have been explored in contact with physiological media and the utilization of these structures as an interface to evoke neuronal signals in a blind retina.

Following are the member of this Unit:

Honorary Professor and Chair

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

Faculty Fellows

James P Chelliah – Ph D

Sheeba Vasu – Ph D

Associate Faculty

Anuranjan Anand – Ph D, F A Sc

K S Narayan – Ph D, F N A Sc, F A Sc, F N A



NEW CHEMISTRY UNIT (NCU)

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 science, materials science and chemical biology. 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, supramolecular 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 ACTIVITIES

Prof C N R Rao's research group: Several aspects of the chemistry of materials are being pursued by Prof CNR 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 MoS₂ and TaS₂. 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 group: Dr Govindaraju's research interest is at the interface of chemistry, biology and (bio)materials science. In particular, organic chemistry, peptide chemistry (peptidomimetics), functional and disease amyloids, molecular probes, nucleic acids and bioinspired (nano)architectonics. In recent times, his group's major research efforts are in the development of diagnostics and therapeutics for currently incurable neurodegenerative diseases such as Alzheimer's (AD) and Parkinson diseases (PD). They are seeking ways to address issues related these diseases by elegantly combining the multidisciplinary-chemical biology approaches. Specifically, working on targeting multiple pathways involved in the pathogenesis of these diseases to develop peptide and small molecule-based therapeutic agents. Hybrid peptoids and small molecule-based molecular tools have been developed in his laboratory, which are capable of clearing the toxic plaques through natural cellular process. The research group is developing molecular probes detecting AD-biomarkers in cerebrospinal fluids (CSF), blood and brain samples, to be used as viable tools for early diagnosis of AD. They have been working on developing probes for (bio)metals that are directly implicated in AD which are currently used to probe and discover therapeutics targeting metal-pathway in AD. Another important area his group has been extensively involved is developing synthetic technology to produce biomimetics of functional amyloids (e.g., spider silk) and their applications as biomaterials.

Dr Subi J George's research group: The underlying theme of Dr George's research lies at the interface between synthetic efforts on pi-conjugated systems and the organisation of these molecules using supramolecular self-assembly principles, with the ultimate aim of developing novel functional organic and hybrid materials. This group target the electronic, optical, chiroptical and self-assembling properties of the pi-conjugated backbone for the design of materials. They have been working extensively on the mixed-stack charge-transfer assemblies for electronic and ferroelectric functionality and also to use them as reversible (stimuli responsive) supramolecular motif to control the functional properties like pore transport and adsorption properties of inorganic porous materials. This group also design solution processable, luminescent organic-inorganic hybrids by the co-assembly ionic dyes and nanoclay particles to modulate various photo-physical and photochemical processes. The research group also synthesize a variety of helical, dynamic assemblies of chromophores to study the mechanistic aspects of supramolecular polymerization process, to use them as a chiroptical probe to monitor enzymatic kinetics and also for the amplification of circularly polarized luminescence. Very recently this group has started exploring new directions in supramolecular chemistry such as supramolecular living polymerization and supramolecular metathesis in order to control the structure and thus function of supramolecular nanostructures.

Dr Jayantha Haldar's research group: 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 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, Dr Haldar's group has developed novel vancomycin analogues 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. They have developed another strategy 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 (AMPs) have also 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. Additionally, the research group investigated anti-inflammatory properties of macromolecular mimic of AMPs and their ability to target intracellular pathogens by synergistic co-delivery of antibiotics in combination with antibiotics in targeting the persister cells that play an important role in bio-films. Some of these small molecular AMP mimics also showed very good activity against Ebola virus. Recently, they have engineered new generation of polymeric biomaterials from synthetic and natural polymers to make any surface antimicrobial, which inactivate various pathogenic bacteria completely on contact and they can be used to prevent the spread of infectious diseases.

Dr Kanishka Biswas' research group is directed towards research in the area of 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-VI₂ (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}Sex system, which has immense importance in industry. The research 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 nanocrystals 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. 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. The role of defects and their contribution to the optical properties of the nanomaterials have been studied using the II-VI semiconductors. 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. More recently, she has developed a new method to co-dope magnetic transition metals into Large nanocrystals upto 50 nm. The magnetic, optical and magneto-optical properties of these materials are being currently studied.

Dr Sebastian C Peter's group focused on research in solid state inorganic materials such as intermetallics, chalcogenides and polyoxometalates from exploratory synthesis. The research group has designed novel rare earth based intermetallics with diverse structural features tuned with interesting physical properties. Two examples are: intrinsic magnetic exchange bias and spin glass behavior. Pd based nanointermetallics have been developed which are efficient and durable catalyst alternative to Pt for the application in fuel cell both as anode and cathode. The group has developed novel chalcogenide glass materials as IR transparent materials. The other interesting outcome during this period is the band gap engineering of the hybrid materials made up of polyoxometalates and organic hybrids.

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 K Pati's group: The effect of the spatial distribution of B, N and C domains in 2-dimensional borocarbonitrides and its influence on carrier mobility has been studied in detail. The multifunctional behavior of two-dimensional transition metal embedded g-C₃N₄ with and without graphene support showed significant promise for application in various fields such as in memory devices and for photo-catalysis. This group showed improved catalytic activity of Rhodium monolayer modified Nickel (110) Surface for the methane dehydrogenation reaction. BN-decorated graphene nanoflakes was explored for their tuneable opto-electronic and charge transport properties.

Dr Sridhar Rajaram's group developed a clear understanding of the charge transfer dynamics in twisted perylene solar cells. The nature of phase segregation in blends of polymer and twisted perylene was studied using a ferroelectric matrix. Using these inputs they have further pushed the efficiencies of perylene containing

cells. In the area of catalysis, it has been shown that sodium cations can be used to control the conformation of organo-catalysts. Additionally, this group has developed a novel cyanide free synthesis of α -amino acids. Studies aimed at understanding the mechanism of this reaction are currently under progress.

Other Departmental Activities

1. 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".
2. Prof Thomas W Ebbesen ISIS & USIAS, University of Strasbourg and CNRS, Strasbourg, France has delivered the Fourth Annual Chemistry Lecture titled "Hybrid Light-Matter States Potential for Molecular and Materials Science" on November 07, 2014.
3. Dr Sarit Agasti has joined as a Faculty Fellow (jointly with CPMU) in the unit.

Following are the members of the Unit:

Linus Pauling Research Professor and 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

Associate Professors

T Govindaraju – Ph D

Subi Jacob George – Ph D

Faculty Fellows

Jayanta Halder – Ph D

Sebastian C. Peter – Ph D

Kanishka Biswas – Ph D

Ranjani Viswanatha – Ph D

Sarit Agasti (Jointly with CPMU) – Ph D

Associate Faculty Members

Swapna K Pati (Professor)

A Sundaresan (Professor)

M Eswaramoorthy (Associate Professor)

Tapas Kumar Maji (Associate Professor)

Sridhar Rajaram (Faculty Fellow)

Honorary Professor

H Ila – Ph D

Research Students

Anjali Devi Das, Udumula Subba Rao, Amit Bhattacharya, Anand Acharya, Anand Kumar Roy, Ananya Banik, Ananya Mishra, Ankit Jain, Arjun Kumar Chittoory, Arkamita Bandyopadhyay, Avijit Saha, Bhawani.N, Chandradhish Ghosh, Divakara SS Murthy Uppu, Ekashmi Rathore, G. Krishnamurthy Grandhi, G. Ramana Reddy, Jiaul Hoque, K. Rajasekhar, Komal Prasad, Krishnendu Jalani, Kushagra Gahlot, Lingampalli Srinivasa Rao, Mahima Makkar, Malabika Chakrabarti, Manjeet Chhetri, Manoj Kumar Jana, Mohini Mohan Konai, Nagarjun N, Pallabi Halder, Pallavi Bothra, Paramita Sarkar, Pramoda K, Promit Ray, Rajkumar Jana, Ramesh M S, S. Vijay Kumar, S. Yugandar, Satya Narayan Guin, Saurav Chandra Sarma, Shikha Dhiman, Shivaprasad Manchineella, Shubhajit Das, Soumyabrata Roy, Subhajit Roychowdhury, Suchi Smita Biswas, Suman Kuila, Sumanta Sarkar, Swastika Banerjee, Yarlagadda Venkateswaralu, Yelisetty Venkata Suseela



Research Associates

S Ramesh, Sandip Samaddar, Sangita Talukdar, Chandra S Voshavar, Avinash M B, Suresh Perumal, Oinam Bijeta Chanu, Chilakapati Madhu, Mohit Kumar, Atul Kumar Dwivedi

Research Associates (Provisional)

Vijaykumar S Marakatti, Saidulu Konda

Senior Research Fellow

B Saraiah

R&D Assistant

Dundappa Mumbaraddi

Secretarial Assistant Trainee

Rajani N

THEORETICAL SCIENCES UNIT (TSU)

Research Achievements

Dr Subir Das research group was involved in addressing problems related to equilibrium and nonequilibrium statistical mechanics. In this broad area, new understanding were obtained on the following specific issues:

1. In the area of Dynamic Critical Phenomena, singularity of shear viscosity in fluid phase transitions was quantified via computer simulation and finite-size scaling analysis.
2. On the topic of Hydrodynamic Effects in Kinetics of Phase Separation, effects of disorder in binary fluid phase separation was studied via molecular dynamics simulations and deviations from the pure case was understood via analytical arguments.
3. On Aging Properties in Ordering Kinetics, behavior of two-time order-parameter autocorrelation during solid binary mixture phase separation and ferromagnetic ordering have been quantified via Monte Carlo simulations and finite-size scaling analysis.
4. In the area of Active Matter, effects of the presence of active particles on the phase behavior of otherwise demixing systems have been studied via a combination of molecular dynamics simulations and integral equation theory.
5. In the area of Granular Matter, energy decay and clustering dynamics in an assembly of inelastically colliding granular particles have been studied and quantified via event driven molecular dynamics simulations and application of finite-size scaling theory.

Dr Kavita Jain's research group has calculated a steady state correlation function in a class of nonequilibrium processes. Studies were undertaken to explore the large time properties of a finite population with arbitrarily high mutation rates. Work on relating population genetics and quantitative genetics were initiated. The fixation probability of a rare wildtype in a large population of mutators have been calculated.

Prof Shobhana Narasimhan's research group worked on gas storage and thermal energy storage applications. It was shown that all three types of van der Waals interactions (London, Debye and Keesom) can be tuned for carbon-based substrates, by suitable modification of the substrate. The Newns-Anderson model was applied to understand the contribution of s and p electrons to gold nanocatalysis. Understanding was gained for the ways in which the adsorption of organic molecules modifies the magnetic properties of metal surfaces.

Prof Swapan Pati's research group studied in detail the effect of the spatial distribution of B, N and C domains in 2-dimensional borocarbonitrides and its influence on carrier mobility. It was discovered that the multifunctional behavior of two-dimensional transition metal embedded g-C₃N₄ with and without graphene support showed significant promise for application in various fields such as in memory devices and for photocatalysis. Improved catalytic activity of Rhodium monolayer modified Nickel (110) Surface for the methane dehydrogenation reaction was demonstrated. BN-decorated graphene nanoflakes were explored for their tuneable opto-electronic and charge transport properties. Structural and magnetic properties of a variety of transition metal incorporated DNA double helices were demonstrated for their possible usage in the field of spintronics.

Dr Meher Prakash's research group performed research activity focusing on understanding function of proteins molecular dynamics. Specifically, two questions were studied – 1. The interdependence of the dynamics of myoglobin protein and its surrounding solvent and how it could be affecting the function of proteins 2. Signaling pathways upon binding drug in G protein coupled receptors which are the most commonly targeted



class of proteins from pharmacological perspective.

Inter-Unit collaborative work (CPMU, TSU and MBGU) has been initiated on topics of shared interests. Specifically, in collaboration with Prof. S. Balasubramanian and Prof. Hemalatha Balaraman's groups, accelerated sampling simulations are being performed on Plasmodium falciparum (PfHGXPRT) that is relevant for malaria vaccine development.

Prof Srikanth Sastry's research group focussed on understanding the nature of yielding and memory in amorphous solids, shear jamming of sphere assemblies, and the nature of fragility in glass formers.

Dr N S Vidhyadhiraja took a one year sabbatical from November 2013 to October 2014, which was utilised to visit Louisiana State University (LSU) as a visiting professor. During the stay at LSU, he worked on the interplay of strong disorder and interactions. He and his host developed a new method known as the typical medium dynamical cluster approximation that can capture the Anderson localization effects in interacting fermionic systems, superconductors, multi-orbital systems, and even phonons. The other main achievement during this year 2014-2015 is the development of an open source software package, that we have named MO-IPT. This package is built for use by the strongly correlated electronic systems community and is capable of producing real frequency density of states, at all interaction strengths and temperatures. The main advantage as compared to quantum Monte Carlo codes is the far less computational expense, and the avoidance of analytic continuation. Moreover, an interface with first principles density functional theory based approaches is also provided that can be used to probe interactions effects in real material calculations.

Members of the Materials Theory group led by **Prof Umesh V Waghmare** predicted ferroelectricity in the 1T form of MoS₂ and determined structures of 1-dimensional defects in graphene and h-BN.

Experimental work has been complemented on use of layered materials in photo-catalytic splitting of water using solar energy with first-principles simulations. Pressure induced topological insulator based on As₂Te₃ was predicted. Interaction of ammonia molecule with Pd-based binary metallic catalysts was analysed. Work was carried out for the analysis of the structural transition in an efficient thermoelectric based on a SnTe-alloy.

New programmes launched during the year

Prof Umesh V Waghmare initiated collaborations with (a) India-Korea Institute for Science and Technology and (b) members of the Center for the Computational Design of Functional Layered Materials, an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science, Basic Energy Sciences under Award # DE-SC0012575.

The investigations of the interplay of interactions effects and disorder in a variety of systems was launched during the year by Dr N S Vidhyadhiraja's group.

The following are the members of the Unit:

Chair

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

Honorary Professor / SERB Distinguished Fellow

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 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
Subir Kumar Das Ph D
N S Vidhyadhiraja Ph D

Faculty Fellow

Meher K Prakash Ph D

Research students

Harish Kumar Singh, Alok Kumar Dixit, Ananthu James, Anjali Singh, Arpita Paul, Bradraj Pandey, Debdipto Acharya , Jiarul Midya, Jyoti Prasad Banerjee, Kaushlendra Kumar, L Jayathi, Meha Bhogra, Monoj Adhikari, Nagamalleswara Rao Dasari, Pawan Kumar, Priyanka , Rajdeep Banerjee, Rukhsan Ul Haq , Saikat Chakraborty, Sarada S, Shashwat Anand, Sona John, Sourav Mondal, Sruthi C K, Subhajit Paul, Sukanya Ghosh, Summayya Kouser, Vasudevan M V, Wasim Raja Mondal

Project Investigator

Siamkhanthang Neihisial

Research Associates

Somesh Kumar Bhattacharya, Devina Sharma, Madhuri Mukhopadhyay, Sandhya Shenoy U

Research Associate

Leishangthem Premkumar

Research Associate (Provisional)

Venkata Srinu Bhadram

R&D Assistants

Kaley Nisheal Michael

Secretarial Assistant Trainee

Anitha G



INTERNATIONAL CENTRE FOR MATERIALS SCIENCE (ICMS)

The International Centre for Materials Science (ICMS), 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 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.

ICMS has extended its facility by adding more equipments: Super-Resolution Microscope, Atomic Layer Deposition (ALD), Analytical Facility, Sonicators, Bridgman Furnace, third Powder XRD System, Second PPMS, Single Crystal XRD, UV-spectrophotometer, Fluorescence spectrometer, FT-IR and a second SQUID system with latest features for magnetic measurements. The new data centre housing the High Performance Computing (HPC) Facility is fully setup and operating. The new H₂O splitting lab in ICMS is also fully setup.

RESEARCH ACTIVITIES

Prof C N R Rao's research group has initiated two major programmes on energy research: one related to artificial photosynthesis involving photocatalytic oxidation of water by nanoparticles of Mn and Co oxides and the other on photocatalytic H₂ generation by hybrid nanostructures by using the Z-scheme, Synthesis, characterization and properties of anion substituted metal oxides and sulfides where in oxygen is replaced by nitrogen and fluorine and sulfur by phosphorous and chlorine are being investigated.

Dr Sridhar Rajaram's research group has developed a clear understanding of the charge transfer dynamics in twisted perylene solar cells. The nature of phase segregation in blends of polymer and twisted perylene was studied using a ferroelectric matrix. Using these inputs, the efficiencies of perylene containing cells were further pushed. In the area of catalysis, the group has shown that sodium cations can be used to control the conformation of organo-catalysts. Additionally, a novel cyanide free synthesis of α -amino acids was developed.

Dr Ranjan Datta's research group has undertaken work in the areas such as: nanoscale optical band gap measurement from defects, cation mixing and regular structure for various inverse spinel thin films by HREELS. The research group also worked in nanoscale quantitative orbital and spin magnetic moment evaluation from defects, cation mixing and regular structure for various inverse spinel thin films by EMCD. A new model was developed to evaluate site specific signal particularly for the inverse spinel structure. Quantitative magnetic order evaluation by HREELS technique from the nanoparticle surface and core regions were separately dealt in the studies. The group also studied thin film growth of ZnO with S and Te alloying to tune the band gap of this system along with some progress made towards solving p-doping issue. Significant understanding is achieved towards establishing type and role of point defects in ZnO. Epitaxial growth of MoS₂ and WS₂ and various heteroepitaxial layer and their physical property assessment by atomic resolution HRTEM and HREELS were studied. Work on single atom sensitive quantitative imaging in oxide system was undertaken.

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. Using this novel technique, she explored the conduction band and valence band variation as a function of size as well as 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. The role of defects and their contribution to the optical properties of the nanomaterials have been studied

using the II-VI semiconductors. 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. More recently, she has developed a new method to co-dope magnetic transition metals into Large nanocrystals upto 50 nm. The magnetic, optical and magneto-optical properties of these materials are being currently studied.

Dr Rajesh Ganapathy's research group has primarily attempted to shed light on the nature of the glass transition. The biggest experimental hurdle in determining whether the glass transition is a purely kinetic phenomenon or a thermodynamic phase transition is the system falls out of equilibrium well before the putative glass transition is reached. Recent simulations have suggested that biasing the thermodynamics of a supercooled liquid by pinning a subset of particles might help unravel the conundrum. The research group has investigated experimentally, the dynamics of particles in colloidal glass forming liquids. Using holographic optical tweezers, we have experimentally realized for the first time the random pinning and amorphous wall geometry. By carefully analyzing particle dynamics in these two geometries, the studies examined in detail the key predictions of the Dynamical Facilitation Theory and the prominent competing thermodynamic framework – Random First Order Transition Theory. The group also investigated glass transition phenomena in suspensions of colloidal ellipsoids with the primary goal being to investigate transport phenomena such as Stokes-Einstein decoupling.

Prof S M Shivaprasad's research group has performed Nano-ELOG growth of GaN and InN thin films on the nanowall network as template, which yield high quality, low defect thin films with unprecedented structural, optical and electrical properties. It was found that nitriding the c-plane sapphire prior to growth results in an improvement of crystalline quality of the resulting nanowall as observed by the reduction in FWHM of (0002) XRC. The formation of GaN nanowall morphology on Si (111) surface by varying nitrogen flux from 2, 4.5 and 6 sccm in PA-MBE growth is proposed. The current-voltage (I-V) characteristics of the GaN films exhibit varying rectifying behavior at 1V with forward to reverse current ratios of 39, 155, 388 for the GaN layers grown at 2, 4.5 and 6 sccm while the reverse leakage current values are 1.2×10^{-3} , 2.6×10^{-4} and 9×10^{-6} A respectively for these junctions. The formation of GaN nanowall network structures by chemical etching was initiated. Etching of dislocations and indentify their types was controlled. However, further plans are to form nanowalls and compare them with the bottom-up thin film growth.

Other Activites

This year Prof Milan K Sanyal of Saha Institute of Nuclear Physics has been offered an adjunct faculty position in ICMS.

The various visiting and fellowship programmes of ICMS have been a success. Mr. Shaswath Anand of Banaras Hindu University; Mr. Harish Kumar of Indian Institute of Technology, Roorkee and Ms. Anjali Devi Das of University of Delhi have graduated under the two semesters (one year) Post Graduate Diploma programme in Materials Science of International Centre for Material Science for the year 2014-15. This year the RAK-CAM Sheikh Saqr Junior Fellowships were awarded to Mr K Gopalakrishnan and Mr S R Lingampalli of CPMU. ICMS has had nine visiting scientists from India, Egypt, Nigeria, UK and USA for research under the short term visiting programme of ICMS.

The collaboration with University Pierre and Marie CURIE, Sorbonne for faculty, student exchange and institutionalization of relationship of the research facility is under progress. ICMS has signed and MoU with the Temple University of the commonwealth system of education.

In addition to carrying out innovative research, ICMS also organizes various seminars, schools, workshops and conferences in collaboration with colleagues in JNCASR and elsewhere. ICMS has also supported financially many conferences and workshops.



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1. Chemical Frontiers Meeting 2014 in Goa, August 16-19, 2014
 2. Conference on Catalysis with the Shell Technology Centre-Bangalore and SISSA-DEMOCRITOS, August 25-29, 2014.
 3. Conference on MD@50, August 26-28, 2014.
 4. Commonwealth Science Conference on November 25-28, 2014
 5. Winter School on “Frontiers of Material Science” with University of Cambridge, UK and SSL, December 1-5, 2014.
 6. The Seventh International Material Lecture was delivered by Prof. Dr. R.J.M. Nolte, Rodboud University, December 1-5, 2014.
 7. International Advisory Board Meeting to be held on December 1, 2014.
 8. A School on Materials and Processes for Applications in Energy and Environment during January 15-18, 2015
 9. IWAM February 22-24, 2015

Following are the members of the Unit:

Director

C N R Rao - FRS , Hon FRSC, Hon F Inst P

Professor

S M Shivaprasad (jointly with CPMU) - Ph D

Associate Professor

Ranjan Datta - Ph D

Faculty Fellow

Rajesh Ganapathy - Ph D

Sridhar Rajaram - Ph D

Ranjani Viswanatha - Ph D

Honorary Faculty

A K Sood - FRS, 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

Sr Research Officer

Jay Ghatak

ICMS Incharge Co-ordinator

Aruna V Mahendarkar

Research Associates

Amitha Shetty

Research Associate (Provisional)

Malleswararao Tangi

Technical Assistant

Prajwal D J

Technical Assistant (Inst)

Maresh J I

Technical Assistant Trainee

Jagadish T

Diploma Students

Harish Kumar Singh, Anjali Devi Das, Shashwat Anand

Graduated students (Post Graduate Diploma Programme)

Rashmi Vinayak Savant

R & D Assistants

Sachin B M, Gururaj Hosamani

Junior Lab Assistant

Mune Gowda H

Visiting Scientists

Adalikwu Stephen Adie, M. Ashraf Shah, Mohd. Ikram, Donourou Diabate, Ukoba, Kingsley Ogheneova, Onumashi Afi, Ibrahim Mohd. Nassar

Shiek Saqr Laboratory

Technical Assistant

Shivakumar K M



THEMATIC UNIT OF EXCELLENCE IN COMPUTATIONAL MATERIALS SCIENCE (TUE-CMS)

Research Achievements

The Grand Canonical Monte Carlo Simulation code, MCIN has been indigenously developed. Adsorption isotherms of CO₂ in many metal organic framework solids and amorphous polymers have been calculated. Comparison to experimental isotherms is excellent.

A coarse grain model for the supramolecular polymerization of benzene tricarboxamides has been developed. Free energy calculations demonstrate the cooperative nature of assembly of the monomers in solution.

For gas storage and thermal energy storage applications, it was shown that all three types of van der Waals interactions (London, Debye and Keesom) can be tuned for carbon-based substrates, by suitable modification of the substrate.

The Newns-Anderson model was applied to understand the contribution of s and p electrons to gold nanocatalysis.

Understanding was gained for the ways in which the adsorption of organic molecules modifies the magnetic properties of metal surfaces.

Analysis of fragility in glass forming liquids has been carried out paying attention to the role of high temperature activation using model potentials. It is seen that one can modulate the fragility that is measured in conventional ways without altering the thermodynamics by tuning barriers to bond breaking. This analysis is being done for more models at present. Extensive analysis has been carried out of the violation of the Stokes-Einstein relation, as well as ways of understanding the relationship between structure, entropy and dynamics. Work addressing jamming in sphere packings, and yielding in amorphous solids is currently being pursued.

The effect of the spatial distribution of B, N and C domains in 2-dimensional borocarbonitrides and its influence on carrier mobility has been studied in detail.

The multifunctional behavior of two-dimensional transition metal embedded g-C₃N₄ with and without graphene support showed significant promise for application in various fields such as in memory devices and for photo-catalysis.

Showed improved catalytic activity of Rhodium monolayer modified Nickel (110) Surface for the methane dehydrogenation reaction.

BN-decorated graphene nanoflakes are explored for their tuneable opto-electronic and charge transport properties.

Structural and magnetic properties of a variety of transition metal incorporated DNA double helices are demonstrated for their possible usage in the field of spintronics.

Predicted ferroelectricity in the 1T form of MoS₂ and determined structures of 1-dimensional defects in graphene and h-BN.

Complemented experimental work on use of layered materials in photo-catalytic splitting of water using solar energy with first-principles simulations.

Predicted pressure induced topological insulator based on As₂Te₃.

Analyzed interaction of ammonia molecule with Pd-based binary metallic catalysts.

Carried out analysis of the structural transition in an efficient thermoelectric based on a SnTe-alloy.

Meetings Organised

1. Mini workshop on 'Special topics in Density Functional Theory' organized at JNCASR by Prof Shobhana Narasimhan on May 12-14, 2014.
2. DFT School at IISER Pune was organized by IISER Pune jointly with JNCASR. Prof. Shobhana Narasimhan was Co-organizer from JNCASR. The School was organised from June 30 to July 12, 2014.
3. MD@50 Conference was organised at JNCASR by Prof S Balasubramanian in collaboration with Prof M L Klein on August 26-28, 2014.
4. Discussion meetings were held on 'Glass formers and glasses' with an aim to create a regular meeting place for detailed discussions in an informal setting of new results concerning glassy systems, including themes of slow dynamics, glass transition, etc, and also related areas in rheology, jamming, gelation etc. The meeting was organised by Prof Srikanth Sastry. Following subsequent meetings of this series took place as below:
 - First meeting (August 8-9, 2014): Theme - Glassy Rheology and Mechanical Behavior of Glasses.
 - Second meeting. (March 27-28, 2015): Theme - Structural aspects of slow dynamics and jamming.
5. Discussion meeting on Water and Aqueous Solutions (www.jncasr.ac.in/ccms/dmwater). January 9-10, 2015 Theme – Biological Water. Organizer: Prof. Srikanth Sastry.
6. School on 'Materials and Processes for Applications in Energy and Environment' was organised by Prof Umesh V Waghmare, Prof Richard Catlow (UC, London) and Prof S-C Lee (IKST) on January 15-17, 2015.

Equipments and Lab facility

A state-of-art 1800 sq. ft., Tier-II data centre was established to house high performance computers. The power density per rack is 30 kW, which is nearly the highest in any datacentre in India.

A new 110 TFlops cluster has been installed in May 2015. In addition to this new cluster, users of TUE-CMS are running jobs on the following three older clusters:

- 4 Tera Flops (7 years old) High Performance Cluster (HPC) 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.

TUE-CMS Visitors Programme

1. Dr. Ranber Singh, Johannes Gutenberg University, Mainz, Germany, Visiting Scientist, with Prof. Pati, for two months from September 2014. Area of research interest: Hydrogen under pressure and semiconductor quantum dots.
2. Dr Santu Baidya, SNBNCBS, Kolkata, Visiting Scientist, with Prof. Waghmare, for three months from October 2014. Area of research interest: Electronic study of transition metal oxides using first principles methods.
3. Mr Soumen Ash, Ph D Student, INST Mohali, Visiting Student, with Prof Waghmare, from January 19 – 27, 2015. Area of research interest: Thermal properties of nanostructured materials.
4. Ms Atreyee Banerjee, Ph D Student, NCL, Pune, Visiting Student, with Prof Sastry, from March 26, 2015 to April 10, 2015. Area of research interest: Dynamics of supercooled liquids.

New Programmes launched during the year

Prof Umesh V Waghmare initiated collaborations with (a) India-Korea Institute for Science and Technology and (b) members of the Center for the Computational Design of Functional Layered Materials, an Energy Frontier Research Center funded by the U S Department of Energy, Office of Science, Basic Energy Sciences under Award # DE-SC0012575.



Following are the members of the Unit:

Coordinator

Prof Balasubramanian Sundaram

Members

Prof Shobhana Narasimhan

Prof Srikanth Sastry

Prof Swapan Pati

Prof Umesh Waghmare

Dr Meher K Prakash

Associate Members

Prof Amalendu Chandra, IIT Kanpur

Prof Sanjoy Bandyopadhyay, IIT Kharagpur

Prof Prabal K. Maiti IISc, Bangalore

Prof S Yashonath IISc, Bangalore

Prof Tanusri Saha-Dasgupta, S.N. Bose National Centre for Basic Sciences, Kolkata

Prof Lavanya M. Ramaniah, Bhabha Atomic Research Centre, Mumbai

Prof P B Sunil Kumar, IIT Madras, Chennai

Prof K P N Murthy, Indira Gandhi Centre for Atomic Research, Kalpakkam

Prof Charusita Chakravarty, IIT Delhi

Prof Surajit Sengupta, S.N. Bose National Centre for Basic Sciences, Kolkata

Prof Gautam Menon, Institute of Mathematical Sciences, Chennai

Prof B Jayaram, IIT Delhi

Prof Rajendra Prasad, IIT Kanpur

Prof Dilip G. Kanhere, University of Pune

Prof G P Das, Indian Association for the Cultivation of Science, Kolkata

Prof Ganapathy Ayappa, IISc, Bangalore

Prof T A Abinandanan, IISc, Bangalore

Prof Indra Dasgupta, Indian Association for the Cultivation of Science, Kolkata

Prof Dilip Angom, Physics Research Laboratory, Ahmedabad

Prof Satyavani Vemparala, Institute of Mathematical Sciences, Chennai

Prof Indira Ghosh, University of Pune

Programme Assistant

Venkatesh K

Staff

Basavaraj T, Bharati Singh, Vijay Amirtharaj A

THEMATIC UNIT OF EXCELLENCE ON NANOCHEMISTRY (TUE-NANO)

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. Nanoparticles of several oxides, chalcogenides, nitrides and carbides have also been synthesized. Porous nanomaterials and metal/metal oxide nanoparticles have been synthesized which are being used in catalytic reactions such as NO_x removal, methane conversion and selective oxidation of hydrocarbons. New class of porous metal-organic framework solids are being examined for their potential applications in gas storage, separation and catalysis; they also possess interesting optical and magnetic properties. Other unique materials being investigated are graphene and functionalised graphene. 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. Various photocatalytic nanocomposites were made and demonstrated to have high activity in water splitting.

Surface physics at sub-monolayer coverage and molecular beam epitaxy of thicker films were combined to produce epitaxial 2D films and nanostructures of III-nitrides. The formed nanostructures were 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. Many careful measurements have been carried out including cathode-luminescence and high resolution electron microscopy. Solution processable organic semiconductors provide a cost effective alternative mainly due to the reduction in processing costs. In order to realize the promise of low cost electronics, the performance of organic materials in electronic devices has to be improved. In this direction, the morphology of the materials is being controlled using synthetic and processing strategies. For example, such optimization has provided a pathway for producing perylene based solar cells with good efficiencies. In addition, there have been activities related to nanomaterials for intracellular drug delivery supramolecular nanofibres and soft materials.

Transparent conductors are ubiquitous among optoelectronic devices. As alternate to ITO, new generation transparent conductor in the form of highly interconnected metal (Au, Ag, Cu etc.) wire networks were developed, invisible to the naked eye, on common substrates such as glass. Unlike the conventional method of dropping nanowires on a substrate, these conducting electrodes (TCEs) are produced employing a newly developed recipe termed as “crackle lithography”. The TCEs thus formed exhibit optoelectronic properties that are superior in many ways, to those of conventional ITO films and other alternate materials. The performance characteristics of the TCEs as well as of devices- solar cells, transparent heaters, transparent capacitor and transparent strain sensor fabricated using the TCEs, were measured. Many non-optoelectronic devices related to transparent electronics such as transparent capacitors, strain sensors, were also fabricated.

Another area being currently pursued is Bioelectronics. Optoelectronic studies of retinal tissue and integration with conducting polymers was tried out with good success. The stimulus generated was monitoring using multielectrode-arrays. Stem cell development on soft elastomeric electrodes is another topic of interest.



Following are the members of this Unit:

Faculty

Prof C N R Rao
Prof G U Kulkarni
Prof A Sundaresan
Prof K S Narayan
Prof S M Shivaprasad
Dr Jayanta Halder
Dr M. Eswaramoorthy
Dr Rajesh Ganapathy
Dr Ranjan Datta
Dr Ranjani Viswanatha
Dr Sebastian C. Peter
Dr Sridhar Rajaram
Dr Subi Jacob George
Dr T Govindaraju
Dr Tapas Kumar Maji
Dr Ujjal Gautam

Technical Assistance

N R Selvi, Govindan Kutty

CSIR CENTRE OF EXCELLENCE IN CHEMISTRY (CSIR-COE)

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

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

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

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

Serious attention is being paid to inorganic analogues of graphene. Various chemical methods have been developed for the synthesis of layered transition metal dichalcogenides which includes MoS₂, WS₂, MoSe₂, WSe₂, NbS₂ and NbSe₂. Their applications in IR detectors, gas sensors, composites with polymers for mechanical properties and electrical properties, magnetic properties, and hydro-desulphurization (HDS) catalysis have been studied. Micromechanical cleavage method has been used for obtaining the single-layers of MoS₂, GaS and GaSe and studied their applications in transistors, detectors and sensors.

It has been discovered that nanosheets of transition metal oxides, such as MoO₃ consisting of only a few-layers prepared by different methods exhibits enhanced photocatalytic activity. Also, it was established that in combination with a borocarbonitride, few-layer MoO₃ composite shows good performance characteristics as a supercapacitor electrode.

High surface area borocarbonitrides were synthesized from low cost starting materials like urea, boric acid and activated charcoal. Graphene-like B_xC_yN_z samples exhibit surface areas in the range 1500-1990 m²/g, with the large uptake values of CO₂ and shows good performance characteristics as supercapacitor electrode.

Photocatalytic water splitting using powder catalyst dispersed in water by simply shining light is one of the most energy effective and easiest ways to obtain H₂ and O₂. Spinel based photocatalysts have been used which contained "Mn₄O₄ cubane" like structure similar to that found in chlorophyll for oxidation water. It was found that nanoparticles of Co, oxides like the spinel Li₂Co₂O₄ and the perovskite LaCoO₃ shows oxygen evolution in solution containing Ru(bpy)₃²⁺. Amongst the manganese oxides studies, Mn₂O₃ with the bixbyite structure and LaMnO₃ with the perovskite structure containing Mn³⁺(t_{2g}³ eg¹) ions show high catalytic activity. Generation of hydrogen by using semiconductor heterostructures and dyes is being investigated.

Aliovalent anion substitution in metal oxides and sulfides causes major changes in electronic properties and structure. Several oxides including ZnO and TiO₂ substituted by N and F have been investigated. P, Cl substituted CdS and ZnS are being examined.



Following is the member of this Centre:

Linus Pauling Research Professor and Chair

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

Glass Blower (Temporary)

Nandha Kishore

COMPUTER LABORATORY (COMPLAB)

Network Upgradation: The existing network in JNCASR campus is upgraded with high speed Gigabit switches along with optical fiber cables which gives high speed Local Area Network (LAN) up to 10Gbps intranet connectivity. Internet bandwidth is increased from 300Mbps to 330Mbps with a combination of service providers, i.e., 100Mbps from National Knowledge Network (NKN), 230Mbps from Aircel. With enhanced Internet bandwidth, each person is given 2Mbps Internet connectivity throughout the campus.

Central Storage Facility: The centralized storage facility(JncCloud) has been set up with a high-speed network storage. All users have been assigned a fixed 5Gb of storage quota for their requirement. With this facility, users are able to store their respective data on centralized storage. This facility can be accessed from both intranet and Internet.

Secured and Enhanced Wi-Fi: We successfully installed high speed Wireless network with 802.11 b/g/n/ac in our Campus. We covered entire Campus with 70 Instant Access Points. Each Access Point is capable of giving 350Mbps to 500Mbps network connectivity with 802.11 b/g/n/ac. Campus Wi-Fi is fully configured with High-End security modules. Wi-Fi Users and visitors are authenticated via our centralized LDAP and CPPM Server.

Enhanced Network Management System: The network management system has been set up in order to ensure security and redundancy of servers and other interconnecting devices like core switch, firewall etc. All critical network components have been put on Active-Active redundancy mode. This will increase the network performance and provide continuous network connectivity in the campus.

Following are the members of CompLab:

Head, CompLab

Dr Santosh Ansumali Ph D

Consultant

Vikas Mohan Bajpai

System Support Staff

D. Mahendravaraman

Trainee

Sampad Biswas

Onsite Engineers

Rajeev Ranjan, Shoaib Mohammad



LIBRARY

The Library has a collection of over 8982 books and access to over 5000 scientific journals. Journal articles were procured on request from faculty members and students from CSIR, DST and other neighbouring libraries under document delivery service.

Overview of Collection

Books	
Books procured during 2014-15	155
Total books in collection	8982
Journals	
Online journals subscribed	166
Print journals subscribed	6
Total Journals subscribed (Online+Print)	172
Patent database (Derwent Patent Index) – from National Knowledge Resource Consortium	1
Abstracting and Indexing database (Web of Science) – from National Knowledge Resource Consortium	Web of Science, SciFinder
Online journals in collection (Subscription + consortium resources)	Over 5000

Books Acquisition

In the financial year 2014-15, 155 books worth Rs. 6,02,767/- (Rupees Six Lakh Two Thousand Seven Hundred and Sixty Seven Only) were procured in the library based on the recommendations of JNCASR Faculty members.

Journal Subscription and Consortium Resources

Total amount spent for the subscription of both print and online journals for the year 2014-15 is Rs. 1,88,02,259.00 (Rupees One crore eighty eight lakh two thousand two hundred fifty nine only). Due to financial constraints, some key resources supported by National Knowledge Resource Consortium were discontinued for 2015 such as Annual Reviews Journals and Science Online.

Document Delivery Service (DDS)

Journal articles on request from faculty and students were procured from libraries across the country and abroad under Document Delivery Service. Total 96 article requests have been fulfilled through inter-library cooperation.

Following are the library staff members:

Sr 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



ACADEMIC PROGRAMMES

ACADEMIC ACTIVITIES

At JNCASR, research is carried out in seven 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), Neuroscience Unit(NSU) and Theoretical Sciences Unit (TSU). The research undertaken is inter-disciplinary in nature.

The Centre offers PhD, Integrated PhD, MS (Research) and MS Engg. degree programmes in Science and Engineering. Students are admitted to the Units mentioned above. The minimum academic qualification required to apply for the MS/PhD programmes of the Centre is MSc./B.E./B.Tech./M.E./M.Tech./MBBS degree/s. Candidates applying for MS/PhD 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 PhD 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 admissions of 2014-15, 42 students joined, and during the mid year admissions of January 2014-15, 10 students joined JNCASR under different degree programmes. The current student strength at JNCASR is 290. The advertisement for the Regular admission to the Integrated PhD, PhD and MS programmes 2015-16 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 2014- March 2015:

Ph D Degrees

Sl.No.	Name of the research scholar
1.	Debabrata Maity
2.	Arun Kumar Manna
3.	Venkata Rao Kotagiri
4.	Sreyoshi Mitra
5.	Ritu Gupta
6.	Sutapa Roy
7.	Jaya Ramulu Kolleboyina
8.	Dhiraj Kumar Singh
9.	Ponnulakshmi V. K.
10.	Avinash M.B.

11.	Urmimala Maitra
12.	Partha Pratim Kundu
13.	Pramod Kumar
14.	Nitesh Kumar
15.	Venkata Srinu Bhadrani
16.	Soumik Siddhanta
17.	Shirodkar Sharmila Narendra
18.	Vini Gautam
19.	Pralok Kumar Samanta
20.	Mohit Kumar



M S (Engg)

Sl.No.	Name of the research scholar
1	Nivedita Sikdar
2	Rohith V.S.
3	Vinay Ishwar Hegde
4	Rashmi Ramaadugu
5	Prashanth P
6	Deepthi S
7	Meha Bhogra
8	Dhake Milind Prakash
9	Naushad Ahmad Kamar
10	Deepak Krishnamurthy

M S (Materials Science) of Integrated Ph D Degree

Sl.No.	Name of the research scholar
1	Abhijit Sen
2	Rajib Sahu
3	Dipanwita Dutta
4	Sonu K.P.
5	Kandula Neelima
6	A.V. Raaghesh
7	Suchitra
8	Uttam Gupta

Master of Science (M S) in Biological Science of Integrated Ph D degree

Sl.No.	Name of the research scholar
1	S.N. Suresh
2	Lakshmeesha K. N.
3	Sundar Ram S.
4	Shreyas Sridhar
5	Mariyam Abdullah Khorakiwala
6	Pooja Barak

Master of Science (M S) in Chemical Science of Integrated Ph D degree

Sl.No.	Name of the research scholar
1	Monali Moirangthem
2	Mohini Mohan Konai
3	Krishnendu Jalani
4	Pallabi Haldar
5	Komal Prasad
6	Yelisetty Venkata Suseela
7	Debopreeti Mukherjee

Postgraduate Diploma in Materials Science

Sl.No.	Name of the research scholar
1	Ankit Kumar Sharma
2	Renu Tomar
3	Manju Unnikrishnan

Postgraduate Diploma in Science Education

Sl.No.	Name of the research scholar
1	Jyothirmayee Kandula
2	Shikha Dwivedi

(c) Student Awards

- Dr Mohit Kumar was the recipient of the Best thesis award under Physical Sciences category for the year 2013-14.
- Dr Sreyoshi Mitra was the recipient of the Best thesis award under Biological Sciences category for the year 2013-14.
- Dr Dhiraj Kumar Singh was the recipient of the Roddam Family Award for the Best PhD thesis in Engineering Mechanics for the year 2013-14.
- Mr Deepak Krishnamurthy received the Roddam Family Award for the Best MS thesis in Engineering Mechanics for the year 2013-14.

(d) Short term Academic Programmes

The following students have joined the Centre's Postgraduate Diploma programmes in Materials Science (PGDMS) and Science Education (PGDSE) respectively:

Post graduate Diploma in Materials Science (PGDMS)	Postgraduate Diploma in Science Education(PGDSE)
Harish Kumar Singh - under Prof. Umesh Waghmare	Rashmi Vinayak Savant- under Dr Sheeba Vasu
Anjali Devi Das- under Prof. Subi Jacob George	
Shashwat Anand- under Prof.Umesh Waghmare	



The students are presently undergoing course work and will be completing their course requirements by July 2015. On successful completion of their course requirements they will be awarded a Postgraduate Diploma of the Centre.

The advertisement for the Postgraduate Diploma in Materials Science and Postgraduate Diploma in Science Education will be released during May 2015.

DISCUSSION MEETINGS

1. JNCASR-FCBS Workshop for Chemistry Students and Teachers, Prof. M.V. George, NIIST, Trivandrum, October 31 - Nov. 2, 2014.
2. CFM 2014, Prof. R. Murugavel, August 16-19, 2014.
3. Advanced Materials: Current Trends and Future Prospects, 2014 at Manali, Himachal Pradesh, Prof. Ashok K Ganguli, May 28 - June 1, 2014.
4. BD Workshop in Flow Cytometry Data Analysis, Prof Ranga Udaykumar, May 19-20, 2014.
5. Workshop on Advances in Materials Science, Yamuna Nair, Christ University, August 27 - 28, 2014.
6. 10th JNCASR Research Conference on Chemistry of Materials, Convener: Dr Subi J George, October 11-13, 2014.
7. European Union and Indo-Italy Meeting, March 10-14, 2015.
8. JNCASR - Purdue University Meeting, March 20-21, 2015.

ENDOWMENT LECTURES

1. **Prof. V Ramalingaswamy Memorial Lecture:** How transcription factors recognize their binding sites?, Prof. Siddhartha Roy, Director, CSIR-Indian Institute of Chemical Biology Director-in-charge, National Institute of Pharmaceutical Education and Research Cluster Director-Biology, Council of Scientific and Industrial Research, July 11, 2014.
2. **C.N.R. Rao Oration Award Lecture 2014:** Peptidomimetics and their Application in Biomimetics and Biomedicine, Dr. T Govindaraju, New Chemistry Unit, JNCASR August 07, 2014.
3. **4th Annual Materials Lecture:** Intricacies of structure, and the connection to property - examples of some functional inorganic materials, Prof. Ram Seshadri, Materials Department and Department of Chemistry and Biochemistry Materials Research Laboratory, University of California, Santa Barbara, USA, October 10, 2014.
4. **DAE-Raja Ramanna Lectures in Physics:** Beyond the standard model through the Higgs portal, Prof. Rohini Godbole, Centre for High Energy Physics, IISc, Bangalore. Prize Lecture: Quantum gravity: a view from general relativity, Prof. Madhavan Varadarajan, RRI, Bangalore, October 21, 2014.
5. **4th Annual Chemistry Lecture:** Hybrid Light-Matter States Potential for Molecular and Material Science, Prof. Thomas W. Ebbesen, ISIS & USIAS, University of Strasbourg And CNRS, Strasbourg, France, November 07, 2014.
6. **Materials Lecture:** Seventh International Materials Lecture delivered by Prof R J M Nolte, Royal Netherlands Academy of Science, Radboud University Nijmegen, Netherlands, December 01, 2014.

SILVER JUBILEE YEAR CELEBRATION LECTURES

1. Brain stem cell progeny create functional units for complex behaviour, Padma Shri Prof K VijayRaghavan, Secretary, Dept. of Biotechnology, Govt. of India, September 25, 2014.
2. Spintronic and Ionitronic Computing Technologies, Stuart S.P. Parkin, Max Planck Institute for Microstructure Physics, Halle, Germany and IBM Research – Almaden, California, USA, December 2, 2014.

JNCASR SPECIAL LECTURES

1. Order, Disorder, Symmetry and Complexity, Prof. Daniel L. Stein, Dept of Physics and Mathematics, New York University, New York, November 12, 2014.



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2. Exposing layers of transcriptome complexity and its use in dissecting complex trait, Dr Lars Steinmetz, V Ramalingaswami Chair, INSA Professor of Genetics, Stanford University, Co - Director, Stanford Genome Technology Center, Associate Head of Genome Biology & Senior Scientist, EMBL, Germany, January 20, 2015.

SYMPOSIA / WORKSHOPS / CONFERENCES / WINTER SCHOOL

1. TUE-CMS DFT Mini Workshop: Special Topics in DFT, Prof. Michael Weinert, University of Wisconsin, Milwaukee, May 12-14, 2014.
2. Hands on Workshop on Cell Sorting Applications, Flow Cell, MBGU, JNCASR and BD Biosciences, August 18-20, 2014.
3. Catalysis Conference, August 25-29, 2014.
4. MD@50, International Conference organized by Prof. Michael Klein, Temple University, Philadelphia and Prof. S. Balasubramanian, JNCASR, August 25-28, 2014.
5. Group Research Conference, Experiments on flat plat boundary layer: New insights, Sourabh Diwan, Imperial College, London, October 30, 2014
6. Indo-Japan Conference on Graphene and related Materials, November 05-06, 2014.
7. Workshop on Single Crystal X-ray diffraction, Dr. Alexander Gerisch, Crystallography, Bruker AXS GmbH, Germany, November 17- 19, 2014.
8. Winter School on “Frontiers of Materials Science 2014” during December 01-05, 2014
9. International Conference on Chromosome Stability, December 14-18, 2014.
10. 13th Eurasia conference on Chemical Sciences, December 14 - 18, 2014.
11. International Workshop and Conference on Operator Theory and Applications, Prof K B Sinha, December 19-20, 2014.
12. National Symposium on Complex Fluids - CompFlu, Dr Santosh Ansumali and Dr Ganesh Subramanian, December 22 - 24, 2014.
13. Gene networks in chromatin / chromosome function, 5th Meeting of the Asian Forum of Chromosome and Chromatin Biology, JNCASR, January 15-18, 2015.
14. Winter-School on “Materials and Processes for Energy and Environment”, January 15-17, 2015.
15. TWAS Regional Conference of Young Scientists on “Nanoscience and Nanomaterials”, February 18-20, 2015.
16. International Conference on Magnetic and Optical Molecular Materials (ICMOMM), March 2-3, 2015.
17. Flow Cytometry Workshop, March 11-12, 2015.

SEMINARS

1. Perovskite solar cells: The new frontier, Prof. Vikram Dalal, Iowa State University USA, May 20, 2014.
2. Temperature and Pressure response of Dense Microgel Suspensions: Structure, Dynamics & Yielding, B. V. R. Tata, Indira Gandhi Centre for Atomic Research, May 21, 2014.
3. Phase Transitions in an Open-Boundary Aggregation-Fragmentation Model, Ms. Himani Sachdeva, TIFR Mumbai, May 27, 2014.
4. Gold Catalyzed Synthesis of 1-Arylnaphthalene Derivatives, Vanajakshi Gudla, University of Hyderabad, Hyderabad, May 28, 2014.
5. Physics of Hubbard-Holstein Model, Prof. G Venkatesh Pai, HRI, Allahabad, June 02, 2014.
6. Intramolecular Vibrational Energy Flow: Analogies, Insights, and Challenges, Dr. K Srihari, IIT Kanpur,

June 17, 2014.

7. Central ideas in FEM with examples, Prof. Sai Jagan Mohan, BITS, Pilani, June 20, 2014.
8. Magnetodielectric and related effects in doped EuTiO_3 and SmMnO_3 , Prof. R. Mahendiran, Department of Physics, National University of Singapore, July, 02, 2014.
9. Fundamental and Applied Aspects of Nanostructured Magnetic Materials, Prof. S. M. Yusuf, Solid State Physics Division, Bhabha Atomic Research Centre, Mumbai, July 10, 2014.
10. Novel vaccine platforms in vaccinology, Dr. Srinivasa Rao, NIH, Bethesda, USA, July 11, 2014.
11. Biological Insights through Exploratory Data Analysis & Systems Biology, Dr. Asoke K Talukder, NIT, Warangal, July 17, 2014.
12. Computational Diagnostic Probes, Dr. N. Arul Murugan, Royal Institute of Technology Stockholm, Sweden, July 24, 2014.
13. Ultra-Porous Materials for Energy and Environmental Applications: from modeling to mass production of porous materials, Dr. Ravichandar Babarao, CSIRO Manufacturing Flagship, Clayton, Victoria, Australia, July 28, 2014.
14. Vibration of Mistuned Bladed Rotor, Prof. Alok Sinha, The Pennsylvania State University, USA, July 30, 2014.
15. Chiral supramolecular motors driven by tunneling current, Dr Puneet Misra, Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Sendai, Japan, August 14, 2014.
16. Modeling dynamics in proteins, Dr. Meher K Prakash, JNCASR, August 21, 2014.
17. Transcription in 3D: The Emerging Story of DNA Quadruplexe-Protein Complexes, Dr. Shantanu Chowdhury, CSIR-Institute of Genomics and Integrative Biology, New Delhi, August 28, 2014.
18. Single-molecule optics in a dynamic trap of plasmonic nanostructures, Dr. Pavan Kumar, IISER Pune, September 01, 2014.
19. Cooling and Brownian Motion in Viscoelastic Granular Gases, Prof. Sanjay Puri, Jawaharlal Nehru University, New Delhi, September 02, 2014.
20. Poiseuille flow of soft amorphous materials, Dr. Pinaki Chaudhuri, The Institute of Mathematical Sciences, Chennai, September 09, 2014.
21. The Structure-Function Studies of Regulated Intramembrane Proteolysis of SpoIVFB : An Homologue of Site 2 Protease in *Bacillus Subtilis*, Sabyasachi Halder, Michigan State University, Michigan, USA, September 12, 2014.
22. Some recent discoveries in ThCr_2Si_2 -type tetragonal pnictide compounds, Dr. Abhishek Pandey, Iowa State University, Iowa, USA, September 26, 2014.
23. Self assembly of colloidal rafts, Dr. Purna Sharma, IISc, Bangalore, September 26, 2014.
24. Metal Complexes: Potential Imaging Agents and Therapeutics, Dr. Ritika Uppal Mukherjee, GE Healthcare, Bangalore, September 29, 2014.
25. Life-altering decisions- To renew, commit, or change fate, Dr. Suchitra Devi Gopinath, Stanford University California, USA, October 09, 2014.
26. Blood cell development and leukemia: insights from *Drosophila*, Prof. Lucas Waltzer, Paul Sabatier University, France, October 14, 2014.
27. Geometric universality of two-dimensional aggregates, Dr. Tamoghna Das, OIST Graduate University, Okinawa, Japan, October 21, 2014.
28. Rethinking the central dogma: epigenetic genome control by non-coding RNAs and its implications for human diseases, Dr. Shiv Grewal, National Cancer Institute, Bethesda, October 31, 2014.



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29. Long-term Potentiation Requires Unique Postsynaptic SNARE Fusion Machinery, Dr. Debanjan Goswami, Stanford University USA, November 03, 2014.
 30. Derivatization of Aldehydes by NHC Catalyzed Redox Activation, Dr. Suman De Sarkar, Institute for Organic and Biomolecular Chemistry, Germany, November 10, 2014.
 31. Self Assembly of Pore Forming Toxins and Kinetic Pathways in Lipid Bilayers K. Ganapathy Ayappa, Prof. K. Ganapathy Ayappa, Indian Institute of Science, Bangalore, November 11, 2014.
 32. Impairment of cell division through ribosomal protein and growth through mitochondrial modulations in Plasmodium, Prof. Shobhona Sharma, TIFR, Mumbai, November 13, 2014.
 33. Nanocrystal Electronics – One Solution to Photovoltaics, Prof. Paul Mulvaney, University of Melbourne, November 17, 2014.
 34. Axonal transport and formation of Long Term Memory, Dr. Sathya Puthanveetti, Scripps Research Institute Florida, November 18, 2014.
 35. Structural insights into the molecular mechanisms of accurate chromosome segregation, Dr. A. Jeyaprakash Arulanandam, University of Edinburgh, November 28, 2014.
 36. Nanoscale Quantum Transport- Paradigms and Possibilities, Prof Bhaskaran Muralidharan, Dept of Electrical Engineering, Indian Institute of Technology Bombay, Mumbai, December 02, 2014.
 37. The Ser/Thr kinase BUB1 and its kinase activity are required for signaling mediated by transforming growth factor, Dr Shyam Nyati, Dept of Radiation Oncology, University of Michigan, December 08, 2014.
 38. Molecular Mechanism of Post-transcriptional Gene Regulation by the HIV-1 Gene Product Rev, Dr L K Venkatesh, Saint Louis University, School of Medicine, Saint Louis, USA, January 9, 2015.
 39. Transcription Regulatory Mechanisms in Animal Cells, Robert G. Roeder, Rockefeller University, January 15, 2015.
 40. FLU Pandemics, Past, Present, Future, Dr Gyan Bhanot, Rutgers University, January 16, 2015.
 41. Measuring Molecules: Mass Spectrometers in Science, Medicine, and Business, Prof. R. Graham Cooks, Department of Chemistry, Purdue University, USA, January 27, 2015.
 42. Building a Neuron for its Function: Deciphering the cellular mechanisms regulating neural patterning, Dr Ramakrishnan Kannan, NINDS/NIH, Maryland, USA, January 28, 2015.
 43. Nanoscale interface formation and charge transfer in graphene/silicon and semiconductor nanorod based solar cells, Prof B R Mehta, Department of Physics, Indian Institute of Technology Delhi, January 28, 2015.
 44. Mechanism of Chaperonin-Assisted Protein Folding: Investigation at Single Molecular Resolution, Dr Shubhasis Haldar, Department of Cellular Biochemistry, Max Planck Institute of Biochemistry, Germany, February 10, 2015.
 45. Origin of Magnetism - 85 years of misunderstanding, Prof Yoshiyuki Kawazoe, Professor Emeritus, New Industry Creation Hatchery Center, Tohoku University, Miyagi, Japan, February 11, 2015.
 46. Microscopic calculation of conformational thermodynamics in bio-macromolecular complexes, Prof J Chakrabarti, S. N. Bose National Centre for Basic Sciences, Kolkata, February 12, 2015.
 47. Adaptive constraints and their natural rescuers: insights from Drosophila aldehyde dehydrogenase, Dr Mahul Chakraborty, University of California, Irvine, February 20, 2015.
 48. Development of chemical tools for target protein modification, Prof. Hiroyuki Nakamura, Chemical Resources Laboratory, Tokyo Institute of Technology, Yokohama, Japan, March 9, 2015.
 49. Anisotropic particles in turbulence, Dr Dario Vincenzi, Laboratoire Jean Alexandre Dieudonné, Université Nice Sophia Antipolis, Nice, France, March 19, 2015.
 50. Process Control for Inkjet Printing of Functional Materials, Prof George T C Chiu, Birck Nanotechnology Center School of Mechanical Engineering, Purdue University, March 19, 2015.

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51. Chemical Tools for Drug Discovery Research in Cancer and Alzheimer's Disease, Prof Kavita Shah, Purdue University, March 23, 2015.

FLUID DYNAMICS COLLOQUIA

1. Granular slip events, electrical precursors, and role of particle shape in jamming transition, Dr. N. Nirmal Thyagu, Max Planck Institute for Dynamics and Self-Organization Goettingen, Germany, June 18, 2014.
2. The dynamics of finite-sized particles in turbulent airflow, Dr. Samridhi Sankar Ray, International Center for Theoretical Sciences, Tata Institute of Fundamental Research, I.I.Sc, Bangalore, July 09, 2014.
3. Group theoretic basis for numerical computation in symmetric problems, Sai Jagan Mohan, Department of Mechanical Engineering, BITS Pilani, Rajasthan campus, July 16, 2014.
4. Shock wave Boundary layer interaction in supersonic flow over a forward-facing step, Prof. Raghuraman N. Govardhan, Department of Mechanical Engineering, IISc, August 27, 2014.
5. Re-entrant, driven and pinned colloidal glasses, Dr. Rajesh Ganapathy, JNCASR, September 10, 2014.
6. Interaction of evolving interfaces during solidification, Mr. Shyamprasad Karagadde, University of Manchester, UK, October 15, 2014.
7. Philosophies and Fallacies in Turbulence Modeling, Dr Philippe Spalart, Senior Technical Fellow, The Boeing Company, Seattle, USA, December 19, 2014.
8. Microfluidics: A versatile platform for biomedical applications, Dr M K S Verma, Harvard Medical School, Cambridge, USA, December 26, 2014.
9. Semiflexible polymers confined in nanochannels: Equilibrium properties and implications to DNA barcoding, Abhiram Muralidhar, Graduate Student Department of Chemical Engineering and Materials Science University of Minnesota, Minneapolis, USA, December 31, 2014.
10. Effect of Interfacial Mass Transfer on the Dispersion in Segmented Flow in Straight Capillaries, Dr. Amol A. Kulkarni, Chemical Engineering Division, National Chemical Laboratory, Pune, January 7, 2015.
11. Direct numerical simulation of turbulence, transition and flow instabilities, Dr Vagesh Murthy, Senior Research Engineer, Norway, February 11, 2015.
12. Active evolvable matter: A perspective from experiments with bacteria, worms, drops and clocks, Dr Shashi Thutupalli, HFSP Cross Disciplinary Fellow, Depts. of Physics, Mechanical Engineering and Integrative Genomics, Princeton University, USA, February 13, 2015.

Short Course

1. Short-range spin glasses: results and applications , Prof. Daniel Stein, New York University, USA, November 11, 13, 18 and 20, 2014.

Guest Lectures

1. An overview of vaccines, the market and unmet needs, Dr. Gita Sharma, Director Research & Quality Control, Tapadia Diagnostics, Hyderabad, July 21, 2014.
2. Modeling HIV pathogenesis, prevention and novel therapies in humanized mice, Dr. Ramesh Akkina, Colorado State University, USA, July 28, 2014.
3. Cervical Cancer - No 1 Killer amongst Indian Women, Dr. Asha V Kumar, Asha Nursing Home, Bangalore, August 21, 2014.

OTHER PROGRAMMES

Hindi Week

Hindi Week was celebrated from September 15-22, 2014. Series of events were organized on this occasion such as antakshari competition, Hindi workshop, "Marx in soho" - play, Hindi talk, Hindi quiz competition, etc.



Hindi Workshop

Hindi Workshop on "*The Art of Letter Writing*", Shri M G Savadatti, December 22, 2014.

Vigilance Programme

The Vigilance Awareness Week was observed in the Centre from October 27 - November 01, 2014.

Annual Faculty Meeting

Closing Ceremony of Silver Jubilee, Annual Faculty Meeting and In-House Symposium held on January 5-6, 2015.

FELLOWSHIP AND EXTENSION PROGRAMMES

VISITING FELLOWSHIP PROGRAMME

The JNCASR Visiting Fellowships 2014-15 were advertised in June 2014 on our website and in Current Science journal. Eleven scientists from different institutions across the country were selected and placed in MBGU, CPMU or TSU for a period of three months tenable between October 2014 -September 2015.

Physics / Chemistry / Materials Sciences and Biological Sciences Categories:

NAME	FACULTY ASSIGNED
Dr Nidhi Chauhan Assistant Professor, Amity Institute of Nanotechnology, Amity Univ. Noida, U.P	Prof. Chandrabhas Narayana
Dr Shubra Singh DST-INSPIRE Faculty, Anna University Chennai, Tamil Nadu	Prof. G.U. Kulkarni
Dr A. Murugeswari Assistant Professor, VIT University, Vellore, Tamil Nadu	Prof. A. Sundaresan
Dr Haribhau Mohan Gholap Assistant Professor, Dept. of Physics Fergusson College, Pune, Maharashtra	Dr. Ranjan Datta
DrVajjiravel Murugesan Assistant Professor, Dept. of Chemistry, B S Abdur Rahman Univ., Vandalur, Chennai, Tamil Nadu	Prof. K.S. Narayan
Dr R Anbarasan Professor, Centre of Research, Dept. of Polymer Technology Kamaraj College of Engg. And Tech., Virudhunagar, Tamil Nadu	Prof. M. Eswaramoorthy
Dr P Murugan Senior Scientist, CSIR Central Electrochemical Research Institute, Karaikudi, Tamil Nadu	Prof. Umesh V Waghmare
Dr Mamata Mohapatra Scientist, Dept. of Hydro & Electrometallurgy CSIR-Institute of Minerals & Materials Technology, Bhubaneswar, Orissa	Prof. C.N.R. Rao
Dr Siva Subrahmanyam Mendu Assistant Professor, Dept. of IE, GIT Gitam University, Vishakapatnam, A.P	Dr. Santosh Ansumali
Dr S. Umadevi Research Scientist, SASTRA University Thanjavur, Tamil Nadu	Prof. M.R.S. Rao
Dr Sreedhar Chinnaswamy Assistant Professor, National Institute of Biomedical Genomics, Kalyani, WestBengal	Prof. Tapas K Kundu



SUMMER RESEARCH FELLOWSHIP PROGRAMME

The SRFP 2015 was announced on JNCASR website and advertised by email to about 150 colleges across the country. 1300 applications were received and 69 scholarships were offered for the year 2015. Under this programme, the students will receive a scholarship of Rs 6000 per month for two months along with admissible travel incidentals.

Category	Applications received (2015)	Fellowships offered (2015)	Applications received (2014)	Fellowships utilized (2014)
Life Sciences	540	16	720	20
Engineering Sciences	154	14	380	11
Atmospheric Sciences	32	00	94	2
Physical Sciences	297	15	470	7
Chemical Sciences	128	22	220	18
Mathematics	90	2	178	3
Materials Science	59	00	94	2
Total	1300	69	2156	63

PROJECT ORIENTED BIOLOGICAL EDUCATION (POBE) AND PROJECT ORIENTED CHEMICAL EDUCATION (POCE)

The POBE-POCE 2015 programme was announced in January 2015 on JNCASR website and advertised by email to over 200 colleges across the country for students enrolled in B.Sc. first year. Ten students were selected for each programme from over 500 applications received. The programme of 2015 will commence on 11 May 2015. The POBE/POCE batches of 2013 and 2014 will return for their second and third year training in laboratories of MBGU and EOBU. Three students will receive Diploma certificates in Biology this year.

Nine students of POCE-2012-14, who had completed the programme successfully, are doing M.Sc. in different institutions in India and abroad. One student of POCE-2013-15 had worked with a faculty member during her winter vacation (December 2014-January 2015).

JNCASR-CICS (CENTRE FOR INTERNATIONAL COOPERATION IN SCIENCE) FELLOWSHIP PROGRAMME

Six scientists from the following countries were shortlisted under the JNCASR-CICS Fellowship Programme 2015-16: Nigeria, Uzbekistan, Ethiopia, Sri Lanka, Zambia and Cameroon. Guides have been identified and they are expected to join them during the next one year.

Name	Country
Dr. Kana Jean Raphael	Cameroon
Dr. Alexander Shula Kefi	Zambia
Dr. Apsara Umayangani Wijenayake	Sri Lanka
Ms. Eneni Mercy Inara Roberts	Nigeria
Dr. Dilafruz Rashidovna Kulmatova	Uzbekistan

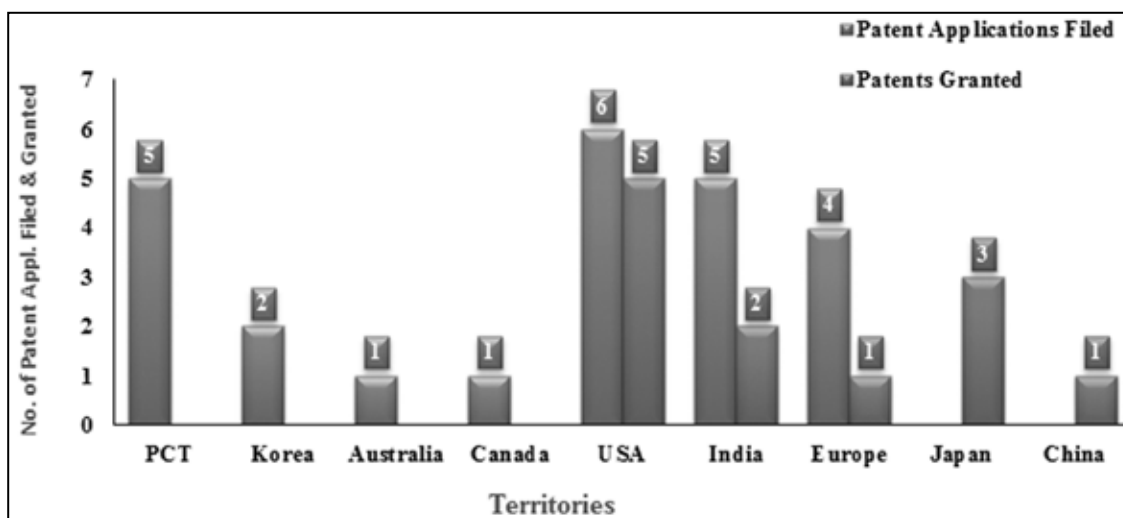
INTELLECTUAL PROPERTY

IP assets (IPAs) are collections of intellectual properties – patents, trademarks, copyrighted works, industrial designs, geographical indications, trade secrets, etc. IP assets have economic value because of their ability to enhance the value and financial return from technologies, products and services.

Realising the importance of IPAs created by research personnel and to foster Academia-Industry Partnership, the Centre constituted an IP Management Committee [IPMC] in 2004. The IPMC developed IPR guidelines to encourage and facilitate the creation, development, protection and management of commercially exploitable IP and its enforcement. The Dean, R&D oversees the activities of the IP Management Cell, which implements the recommendations/suggestions of the IPMC. The Centre has so far filed 193 (India-65, PCT-42, USA-43, Europe-18, Japan-6, China-5, Korea-4, Australia-3, S.Africa-2, Brazil-2, Vietnam-1, Israel-1, Canada-1) patent applications and obtained 40 (India-8, USA-20, Europe-4, Japan-3, S.Africa-2, Australia-1, Korea-1, China-1) patent grants, in addition to registering one Industrial Design and One Trade Mark.

During the reporting year, the researchers at the Centre developed several new inventions. The IPMC reviewed strategically and recommended filing of 24 patent applications (International Patent Application under PCT-5, Korea-2, Australia-1, Canada-1, USA-6, India-5, Europe-4) for commercialisable inventions meeting the patentability criteria. The Centre has also obtained 12 (USA-5, India-2, Europe-1, Japan-3, China-1) patent grants.

Graphical Representation of the Patent Applications Filed and Patents Granted (2014-2015)



PATENT APPLICATIONS FILED

I. Indian Provisional Patent Applications

- Govindaraju Thimmaiah et al, Appl. No. 1819/CHE/2014, filed on 4/4/2014.
- Giridhar Udapi Rao Kulkarni et al, Appl. No. 2713/CHE/2014, filed on 3/6/2014.
- KR Sreenivas et al, Appl. No. 6354/CHE/2014, filed on 17/12/2014.
- Jayanta Haldar et al, Appl. Nos. 6565/CHE/2014, filed on 25/12/2014, and 605/CHE/2015, filed on 6/02/2015).



II. International Patent Applications under PCT

Title of the Invention	Inventors	Application No.	Date of filing
A Process for Bromination of Arylene Dianhydrides and a Method of Synthesis of Diimides Thereof	Govindaraju Thimmaiah, Venkata Suseela Yelisetty	PCT/IB2014/061657	23-05-2014
A Method of Synthesising Intermetallic Compounds and Applications Thereof	Sebastian Chirambatte Peter, Pradeep Prasannamurthy Shanbogh, Udumula Subbarao	PCT/IB2014/063418	25-07-2014
Vancomycin-Sugar Conjugates and Uses Thereof	Jayanta Halder, Yarlagadda Venkateswarlu, Goutham Belagula Manjunath, Mohini Mohan Konai	PCT/IB2014/001835	16-09-2014
Chitin Derivatives, Method for Production and Uses Thereof	Jayanta Halder, Jiaul Hoque, Goutham Belagula Manjunath, Padma Akkapeddi	PCT/IB2014/002788	16-12-2014
Antimicrobial Conjugates, Method For Production And Uses Thereof	Jayanta Halder, Mohini Mohan Konai, Miles Carroll	PCT/GB2015/050750	13-03-2015

III. US Patent Applications

Title of the Invention	Inventors	Application No.	Date of filing
Polynucleotide Sequences of Candida dubliniensis and probes for Detection	Kaustuv Sanyal, Sreedevi Padmanabhan, Jitendra Thakur	14/248,249	8-04-2014
Cationic Antibacterial Composition	Jayanta Halder, Yarlagadda Venkateswarlu, Akkapeddi Padma	14/357,928	13-04-2014
A System and A Method To Detect Hydrogen Leakage Using Nano-Crystalised Palladium Gratings	Giridhar U Kulkarni, Ritu Gupta, Abhay A Sagade	14/372,693	16-07-2014
An Organic Solar Cell and Methods Thereof	Kavassery Sureswaran Narayan, Anshuman Jyothi Das	14/388,056	25-09-2014
A Nanosphere-Histone Acetyltransferase (HAT) Activator Composition And Process Thereof	Tapas Kumar Kundu, Anne-Laurence Boutillier, Snehajyoti Chatterjee, Muthusamy Eswarmoorthy, Puspak Mizar, Chantal Mathis, Jean-Christophe Cassel, Romain Neidl, Mohankrishna Dalvoy Vasudevarao, Vedamurthy Bhusainahalli Maheswarappa	14/397,561	28-10-2014
Nanoparticle Compositions of Antibacterial Compounds And Other Uses Thereof	Jayanta Halder, Divakara Siva Sathyanarayana Murthy Uppu, Akkapeddi Padma, Goutham Belagula Manjunath	14/421,086	11-02-2015

IV. European Patent Applications

Title of the Invention	Inventors	Application No.	Date of filing
Cationic Antibacterial Composition	Jayanta Halder, Yarlagadda Venkateswarlu, Akkapeddi Padma	12813463.2	12-06-2014
An Organic Solar Cell and Methods Thereof	Kavassery Sureswaran Narayan, Anshuman Jyothi Das	12812359.3	13-10-2014
A Nanosphere-Histone Acetyltransferase (HAT) Activator Composition And Process Thereof	Tapas Kumar Kundu, Anne-Laurence Boutillier, Snehajyoti Chatterjee, Muthusamy Eswarmoorthy, Puspak Mizar, Chantal Mathis, Jean-Christophe Cassel, Romain Neidl, Mohankrishna Dalvoy Vasudevarao, Vedamurthy Bhusainahalli Maheswarappa	13731163.5	28-11-2014
Nanoparticle Compositions Of Antibacterial Compounds And Other Uses Thereof	Jayanta Halder, Divakara Siva Sathyanarayana Murthy Uppu, Akkapeddi Padma, Goutham Belagula Manjunath	13750386.8	6-02-2015

V. Korean Patent Applications

Title of the Invention	Inventors	Application No.	Date of filing
Cationic Antibacterial Composition	Jayanta Halder, Yarlagadda Venkateswarlu, Akkapeddi Padma	10-2014-7016259	13-06-2014
Nanoparticle Compositions Of Antibacterial Compounds And Other Uses Thereof	Jayanta Halder, Divakara Siva Sathyanarayana Murthy Uppu, Akkapeddi Padma, Goutham Belagula Manjunath	10-2015-7003396	6-02-2015

VI. Australian and Canadian Patent Applications

Title of the Invention	Inventors	Application No.	Date of filing
Cationic Antibacterial Composition	Jayanta Halder, Yarlagadda Venkateswarlu, Akkapeddi Padma	2855753	13-06-2014
		2012338461	10-06-2014



PATENTS GRANTED

Title of the Invention	Inventors	Territory	Patent No.	Granted on
A Method of Manufacturing A Mirrior To Perform SERS	Chandrabhas Narayana, Pavan Kumar Gopalapura Venkataramu	India	260215	8-04-2014
A High Sensitivity Assay for Molecular Typing of Biological Sample, Probes and a Kit Thereof	Ranga Udaykumar, Chandrabhas Narayana, Jayasuryan Narayana	Europe	2104742	7-05-2014
Tat DNA Sequences, Gene Constructs, Vaccine and Processes Thereof	Ranga Udaykumar	Japan	5576859	11-07-2014
Nanoparticles Composition and A Process Thereof	Chandrabhas Narayana	India	262,752	10-09-2014
		USA	8,834,917	16-09-2014
Vector, Vector Combinations, Methods And Kit Thereof	Ranga Udaykumar	USA	8841121	23-09-2014
Inhibition of Histone Acetyltransferases by CTK7A and Methods Thereof	Tapas Kumar Kundu, Mohammed Arif, Kempegowda Mantelingu, Gopinath Kodaganur Srinivasachar	China	ZL20108 00452916	1-10-2014
A Template Free Metal, Polymer Free Metal Nanosponge and a Process Thereof	Eswaramoorthy Muthusamy, Saikrishna Katla	Japan	5637983	31-10-2014
Optimal Wing Planforms for Reducing the Induced or Total Drag of the Wing of an Aircraft Driven by Wing-Mounted Tractor Propellers/Rotors	Roddam Narasimha, Madhusudan Deshpande, Praveen Chandrashekarappa, Rakshith Belur Raghavan	Japan	5658248	5-12-2014
		USA	8,915,467	23-12-2014
Solvent-free Oxidation of Toluene By Nanoparticles of Cd and Zn Peroxides under favourable operating conditions	Chintamani Nagesa Ramachandra Rao, Ujjal Kam Gautam, Srinivasa Rao Lingampalli	USA	8957255 B2	17-02-2015
Intrinsically Fluorescent Carbon Nanospheres And A Process Thereof	Tapas Kumar Kundu, Eswaramoorthy Muthusamy, Selvi Bharatha Ruthrotha Vikru, Dinesh Jagadeesan	USA	Received Notice of Allowance	30-03-2015

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



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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 CO₂ incubator etc
4. Maskless Lithography system
5. UV VIS NIR TRIR and LS55 spectrofluorimeter
6. Innova 4r and Innova 42R refrigerated 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 / ONGOING RESEARCH PROJECTS

Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
01	J C Bose Fellowship	Amitabh Joshi	SERB	5 years
02	Congenital Deafness in Dhadkai village of Doa district of Jammu & Kashmir	Anuranjan Anand	ICMR	2 years
03	MoU between SHELL and JNCASR entitles: "To develop and validate a predictive method for modelling physical properties of hydrocarbons"	Balasubramanian S.	SHELL	2 years
04	Thematic Unit of Excellence on "Computational Materials Science" at JNCASR	Balasubramanian S.	DST	5 years
05	Evaluating earthquake/tsunami recurrence along the Andaman are from the study of shallow cores	C. P. Rajendran	DST	3 years
06	Collaborative projects between JNCASR/ ICMS & DST	C N R Rao	DST	--
07	Collaborative Programme between DRDO and JNCASR	C N R Rao	DRDO	5 years
08	CSIR Centre of Excellence in Chemistry at JNCASR	C N R Rao	CSIR	5 years
09	MoU between PAK-CAM and JNCASR	C N R Rao	SSL	
10	Post doctoral fellowship in Nano-Science and Technology	Co-ordinated by JNCASR	DST	Cont.
11	Unit on NanoScience & Technology- UNANST - DST	Co-ordinated by JNCASR	DST	--
12	Thematic Unit of Excellence on Nanochemistry at JNCASR	G U Kulkarni	DST	5 years
13	ICPC NanoNet Coordination and support action	G U Kulkarni	ICPCNN	Cont.
14	India-European Union (EU) research project "Organic and Organic-Inorganic hybrid solar Cells:Optimization of Materials Properties, Bulk Heterojunction Morphology and Device Efficiencies (OISC/LARGE CELLS)	G U Kulkarni	DST	3 years



Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
15	Indo-US joint networked R&D centre on “Nanomaterials for Energy”	G U Kulkarni & Timothy S Fisher, BNC, Purdue University, USA	IUSSTF	Cont.
16	Ramanujan Fellowship	Jayanta Haldar	DST	5 years
17	Estimating the lift in flapping flight for the design of Entomopter/MAV	K R Sreenivas	ADE	3 years
18	Ramanujan Fellowship	Kanishka Biswas	SERB	5 years
19	Structure-function analysis of centromeres of a pathogenic budding yeast candida tropicali	Kaustav Sanyal	DBT	3 years
20	Identification of DNA replication origins and origin binding proteins of the human pathogen, Candida albicans	Kaustav Sanyal	DBT	3 years
21	Identification of centromeres of the budding yeast Saccharomyces Castellii	Kaustav Sanyal	DBT	3 years
22	Role of histone H3 variants in genome indexing in Candida albicans	Kaustav Sanyal	SERB	3 years
23	Characterisation of the fungal specific Dam-1 complex as an attractive target for safer and more potent anti fungal drug to treat candidiasis	Kaustav Sanyal, Co-PI: Anuranjan Anand	DBT	3 years
24	MoU between JNCASR and NCI (Nippon Chemical Industrial Co. Ltd.) on project “Develop inorganic nanomaterials for drug release”	M Eswaramoorthy	NCI	--
25	J.C. Bose Fellowship	M R S Rao	DST, JCB	5 years
26	Reprogramming somatic cells to model cardiovascular differentiation for research and therapeutic potential	Maneesha Inamdar	DBT	3 years
27	Analysis of factors regulating self renewal and differentiation to aid generation of lineage restricted stem cells/progenitors for cell replacement therapy	Maneesha Inamdar & Hemalatha Balaram	DBT	3 years
28	Analysis of conserved pathways involved in maintaining homeostasis and survival in mammals and Drosophila	Maneesha S Inamdar	WT	3 years

Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
29	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 Pancreatic Beta Cells & Cardiomyocytes"	Maneesha S Inamdar	DBT	3 years
30	DAE-SRC Outstanding Research Investigator Award for the project titled "Dynamics and patterns in granular fluid: theory and experiment"	Meheboob Alam	DAE	3 years
31	Analysis of in vivo transcription of plasmodium falciparum from Indian patents suffering from cerebral malaria and its comparison with that from patents infected with severe malaria (with MOD) symptoms	Namita Surolia	ICMR	3 years
32	Delineating viral determinants of HAD using SCID mice	Ranga Udaykumar	AECOM	Cont.
33	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
34	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
35	Pulsed Laser Desposition (PLD) growth of ZnO BCN and study their properties from atomic scale imaging and spectroscopic techniques	Ranjan Datta	SERB	3 years
36	Synthesis & study of the optical magnetic & electrical properties of co-doped II-IV semiconductor nanocrystals	Ranjani Viswanatha	DST	3 years



Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
37	Welcome Trust - DBT India Alliance award to Ravi Manjithaya an Intermediate Fellowship entitles: Small molecule modulators of autophagy and autophagy related pathways	Ravi Manjithaya	WT-DBT	5 years
38	MoU between JNCASR & HPCL "Development of Microbial catalysts (Biocatalysts) for Fermentative Butanol Production	Ravi Manjithaya	HPCL	2 years
39	Numerical Simulation of cloud flow and mixing layers	Roddam Narasimha	INTEL	1 year
40	DNS of Turbo-Machinery Blading	Roddam Narasimha	GTRE	2 years
41	The year-of-science Professorship	Roddam Narasimha	DST	5 years
42	Aerodynamic shape optimization	S M Deshpande	INTEL	1 year
43	Grid-based libraries	Santosh Ansumali	INTEL	1 year
44	Ramanujan Fellowship	Sebastian C Peter	DST	5 years
45	Rare earth doped chalcogenide glasses for optical and photonic applications	Sebastian C Peter	SERB	3 years
46	Structure-property relations in RE ₂ TGe ₃ (RE=rare earths; T=transition metals) compounds" (CRS-M-166)	Sebastian C Peter	UGC	3 years
47	A study of the interactions between the circadian clock & homeostatic mechanisms regulating sleep & arousal in Drosophila melanogaster	Sheeba Vasu	SERB	3 years
48	Computational modeling on fuels cells for clean and efficient energy storage	Siamkhanthang Neihisial	SERB	3 years
49	Ramanujan Fellowship	Subir Kumar Das	DST	5 years
50	J C Bose Fellowship	Swapan K Pati	DST-JCB	5 years
51	Nano2Fun	Swapan K Pati & Subi Jacob George	EU	
52	Indo-Italian Project entitled: From Small Molecules to Advanced Molecular Materials:Transport and Transfer Properties	Swapan K. Pati	DST	3 years

Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
53	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
54	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
55	Developing novel chemosensors of metal ions in aqueous media for environmental & biological applications	T Govindaraju	CSIR	3 years
56	Innovative Young Biotechnologists Award, project entitles: “Development of Biomimetic Materials as substitutes for Natural Fibers using Designed Modular Peptides”	T Govindaraju	DBT	3 years
57	J C Bose Fellowship	Tapas Kumar Kundu	DST	5 years
58	Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory	Tapas Kumar Kundu	IFCPAR	3 years
59	Regulation of Chromatin Associated proteins by miRNAs: Implications in Breast Cancer	Tapas Kumar Kundu	DBT	3 years
60	India - Japan project entitled : Mechanism of Chromatin Repair, role of chromatin Associated Protein PC4 Acetylation by Tip60	Tapas Kumar Kundu	DST	2 years
61	Targeting protein lysine acetylation in oral cancer and neurodegenerative disorders using nanomaterials	Tapas Kumar Kundu & Eswaramoorthy M	DBT	3 years
62	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



Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
63	Between - group encounters and its correlates in female asian elephants	T N C Vidya	CSIR	2 years
64	Between - Group encounters & its correlates in female Asian Elephants	T N C Vidya	NGS	2 years
65	J C Bose Fellowship	Umesh V Waghmare	DST	5 years
66	Alloy development and mechanical behaviour	Umesh V Waghmare	GEGR	2 years
67	Density functional theory calculations	Umesh V Waghmare	P&G	1 year

NEW SPONSORED RESEARCH PROJECTS

(Started during 2014-2015)

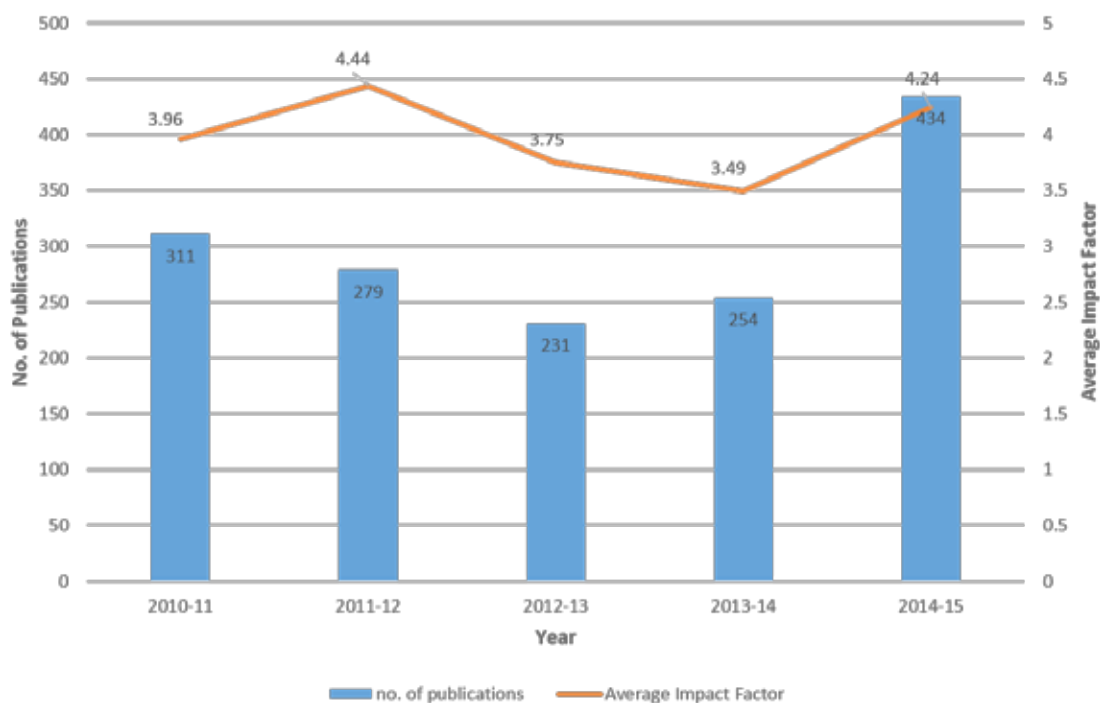
SI No	Title of the project	Project Investigator	Funding Agency	Duration
1	Clay Stabilized Metal Nanoparticle for Catalysis	Eswaramoorthy M	SHELL	
2	Controlled release dispensers for delivery of semiochemicals	Eswaramoorthy M	DBT	3 years
3	Theranostic approach for Mechanistic Understanding & Discovery of Novel Inhibitors of Neurodegenerative Diseases	Govindaraju T	SERB	3 Years
4	Development of Nucleic acid hybrid nanosystem & materials for drug targeting Delivery and Biosensing Applications	Govindaraju T	DBT	3 years
5	Holocene Climate changes and Tracking the Impact of Anthropogenic Activity in Wular or Mansar Lake in Kashmir Himalaya: Appraisal of Human Influence	Jaishri Sanwal Bhatt	SERB	3 years
6	Impact of Syngap 1 Heterozygous mutations on the Maturation & Function of GABAergic Interneurons during Development	James P Chelliah	SERB	3 years
7	Development of Novel Organic-Inorganic Antimicrobial with Hydroxyapatite & Antimicrobial Polymer	Jayanta Haldar	DST	3 years
8	SERB Distinguished Fellowship	K B Sinha	SERB	5 years
9	SERB Distinguished Fellowship	M R S Rao	SERB	5 years
10	Chromatin Biology Research - Phase II	M R S Rao	DBT	3 years
11	Analysis of human development EMT in vitro & establishment of ex vivo models of embryogenesis	Maneesha S Inamdar	DBT	3 years
12	Experiments using Salt water/Fresh water Test facility of Buoyancy induced flow studies	Meheboob Alam	BARC	3 years
13	Improving Organic Solar Cell Performance in large area architecture by use of Active Encapsulation and Aging studies	K S Narayan	DST	3 years
14	The biological significance of unique NF-Kb binding site in the viral promoter of HIV -1 sub type C	Ranga Udayakumar	SERB	3 years



Sl No.	Title of the project	Project Investigator(s)	Funding Agency	Duration
15	Structure - property relations in the RE ₂ TSi ₃ (RE=RARE EARTHS: T-Transition Metals) Compounds	Sebastian Peter	CSIR	3 Years
16	Oxidation Mechanism of Cobalt Nanoclusters	Shobhana Narasimhan	SHELL	1 Year
17	Computational modeling on fuels cells for clean and efficient energy storage	Siamkhanthang Neihisial	SERB	3 years
18	Investigating the role of BLM helicase as a global tumor suppressor: understanding its regulatory loops and using the knowledge for therapeutic and clinical applications in cancer biology	Tapas Kumar Kundu	DBT	3 years
19	Between - group encounters and its correlates in female asian elephants	T N C Vidya	CSIR	3 years
20	Tuning coupled Dynamics of Electrons and Phonons in MoS ₂ with Strain, Substrate and Electronics	Umesh Waghmare	AOARD	3 years
21	Plasticity of covalent Nanoparticles	Umesh Waghmare	CEFIPRA	3 years
22	UKIERI Award between Purdue University, JNCASR & University College of London	Umesh Waghmare	UKIER	
23	Tools for precise characterization of bonding in materials for catalysis	Umesh Waghmare	IKST	
24	Towards Review Meeting of Chemical Science Fellows under Ramanujan - 06-07th June 2014	-	SERB	1 year

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. Gupta, N.; Gupta, D.; Aggarwal, S.; Siddhanta, S.; Narayana, C.; Barshilia, H. C., Thermally Stable Plasmonic Nanocermets Grown on Microengineered Surfaces as Versatile Surface Enhanced Raman Spectroscopy Sensors for Multianalyte Detection. **ACS Applied Materials & Interfaces** 2014, 6 (24), 22733-22742. <http://dx.doi.org/10.1021/am506879h>
2. Gupta, R.; Rao, K. D. M.; Srivastava, K.; Kumar, A.; Kiruthika, S.; Kulkarni, G. U., Spray Coating of Crack Templates for the Fabrication of Transparent Conductors and Heaters on Flat and Curved Surfaces. **ACS Applied Materials & Interfaces** 2014, 6 (16), 13688-13696. <http://dx.doi.org/10.1021/am503154z>
3. Gupta, R.; Reifenger, R. G.; Kulkarni, G. U., Cellphone Camera Imaging of a Periodically Patterned Chip as a Potential Method for Point-of-Care Diagnostics. **ACS Applied Materials & Interfaces** 2014, 6 (6), 3923-3929. <http://dx.doi.org/10.1021/am4050426>
4. Kurra, N.; Reifenger, R. G.; Kulkarni, G. U., Nanocarbon-Scanning Probe Microscopy Synergy: Fundamental Aspects to Nanoscale Devices. **ACS Applied Materials & Interfaces** 2014, 6 (9), 6147-6163. <http://dx.doi.org/10.1021/am500122g>
5. Saibal, B.; Ashar, A. Z.; Devi, R. N.; Narayan, K. S.; Asha, S. K., Nanostructured Donor-Acceptor Self Assembly with Improved Photoconductivity. **ACS Applied Materials & Interfaces** 2014, 6 (21), 19434-19448. <http://dx.doi.org/10.1021/am5055542>
6. Suresh, V. M.; Bonakala, S.; Atreya, H. S.; Balasubramanian, S.; Maji, T. K., Amide Functionalized



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- Microporous Organic Polymer (Am-MOP) for Selective CO₂ Sorption and Catalysis. **ACS Applied Materials & Interfaces** 2014, 6 (7), 4630-4637. <http://dx.doi.org/10.1021/am500057z>
7. Narayanamoorthy, B.; Datta, K. K. R.; Eswaramoorthy, M.; Balaji, S., Highly Active and Stable Pt₃Rh Nanoclusters as Supportless Electrocatalyst for Methanol Oxidation in Direct Methanol Fuel Cells. **ACS Catalysis** 2014, 4 (10), 3621-3629. <http://dx.doi.org/10.1021/cs500628m>
 8. Angmo, D.; Sommeling, P. M.; Gupta, R.; Hosel, M.; Gevorgyan, S. A.; Kroon, J. M.; Kulkarni, G. U.; Krebs, F. C., Outdoor Operational Stability of Indium-Free Flexible Polymer Solar Modules Over 1 Year Studied in India, Holland, and Denmark. **Advanced Engineering Materials** 2014, 16 (8), 976-987. <http://dx.doi.org/10.1002/adem.201400002>
 9. Senanayak, S. P.; Narayan, K. S., Strategies for Fast-Switching in All-Polymer Field Effect Transistors. **Advanced Functional Materials** 2014, 24 (22), 3324-3331. <http://dx.doi.org/10.1002/adfm.201303374>
 10. Gautam, V.; Rand, D.; Hanein, Y.; Narayan, K. S., A Polymer Optoelectronic Interface Provides Visual Cues to a Blind Retina. **Advanced Materials** 2014, 26 (11), 1751-1756. <http://dx.doi.org/10.1002/adma.201304368>
 11. Rao, K. D. M.; Gupta, R.; Kulkarni, G. U., Fabrication of Large Area, High-Performance, Transparent Conducting Electrodes Using a Spontaneously Formed Crackle Network as Template. **Advanced Materials Interfaces** 2014, 1 (6), 7. <http://dx.doi.org/10.1002/admi.201400090>
 12. Haldar, R.; Matsuda, R.; Kitagawa, S.; George, S. J.; Maji, T. K., Amine-Responsive Adaptable Nanospaces: Fluorescent Porous Coordination Polymer for Molecular Recognition. **Angewandte Chemie-International Edition** 2014, 53 (44), 11772-11777. <http://dx.doi.org/10.1002/anie.201405619>
 13. Kumar, B.; Rao, K. V.; Sampath, S.; George, S. J.; Eswaramoorthy, M., Supramolecular Gating of Ion Transport in Nanochannels. **Angewandte Chemie-International Edition** 2014, 53 (48), 13073-13077. <http://dx.doi.org/10.1002/anie.201406448>
 14. hakraborty, A.; Maji, T. K., Mg-MOF-74@SBA-15 hybrids: Synthesis, characterization, and adsorption properties. **APL Materials** 2014, 2 (12), 7. <http://dx.doi.org/10.1063/1.4902816>
 15. Gupta, U.; Naidu, B. S.; Maitra, U.; Singh, A.; Shirodkar, S. N.; Waghmare, U. V.; Rao, C. N. R., Characterization of few-layer 1T-MoSe₂ and its superior performance in the visible-light induced hydrogen evolution reaction. **APL Materials** 2014, 2 (9), 8. <http://dx.doi.org/10.1063/1.4892976>
 16. Radha, B.; Sagade, A. A.; Kulkarni, G. U., Metal-organic molecular device for non-volatile memory storage. **Applied Physics Letters** 2014, 105 (8), 4. <http://dx.doi.org/10.1063/1.4893755>
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 19. Mua, N. T.; Sundaresan, A.; Man, N. K.; Dung, D. D., Influence of preparation conditions on superconducting properties of Bi-2223 thin films. **Bulletin of Materials Science** 2014, 37 (1), 19-25. <http://dx.doi.org/10.1007/s12034-014-0627-8>
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 22. Asatkar, A. K.; Senanayak, S. P.; Bedi, A.; Panda, S.; Narayan, K. S.; Zade, S. S., Zn(II) and Cu(II) complexes of a new thiophenebased salphen-type ligand: solution-processable high-performance
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AWARDS / DISTINCTIONS

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

Awards

Prof C N R Rao

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

Honorary D Sc from the University of St Andrews, UK

Basavashri Prasasthi 2014 from Basava Vedike, Bangalore on occasion of Basava Jayanthi.

Felicitation by Hon'ble Chief Minister, Govt. of Karnataka was held on 18.06.2014 at Vidhana Soudha, Bangalore for his receiving the Country's Highest Civilian Award Bharat Ratna.

Felicitation by Hon'ble Chief Minister, Govt of Karnataka at University of Mysore for his receiving Bharat Ratna.

Delivered 17th JRD Memorial Lecture in New Delhi organized by ASSOCHAM

Doctor of Science (honoris causa) from Australian National University

Prof K S Valdiya

Padma Bhushan Award for the year 2015

Prof M R S Rao

Distinguished Alumnus Awards for the year 2014 by Alumni Association of IISc

Prof Roddam Narasimha

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

Senior Guru Award by Alumni Association of IISc

Mrs Indumati Rao

Conferred the Honorary Doctorate in Literature by the Karnataka State Women's University, Bijapur in recognition of her contributions for the cause of popularizing science education.

Prof Umesh V Waghmare

Gold Medal of the Indian Institute of Metals, Kolkata.

Prof Vijay Kumar Sharma

Invited to deliver a Plenary Lecture in the biannual meeting of Society for Research in Biological Rhythms (SRBR) organized in Big Sky, Montana, USA from June 14 - 18, 2014.

Prof Shobhana Narasimhan

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

Prof Srikanth Sastry

IIT Bombay Distinguished Alumnus Award 2015



Prof Meheboob Alam

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

Dr M Eswaramoorthy

CRSI bronze medals for the year 2015

Dr Subi J George

CRSI bronze medals for the year 2015

Emerging Investigator by Journal of Materials Chemistry (2014)

Dr Tapas K. Maji

Materials Research Society of India (MRSI) Medal 2014

Dr Sheeba Vasu

Invited to deliver a Plenary Lecture in the biannual meeting of Society for Research in Biological Rhythms (SRBR) organized in Big Sky, Montana, USA from 14th June until 18th June 2014.

Invited to deliver a lecture in the International meeting on Neuro modulation of behaviour, organised at NCBS, Bangalore in October 29-30, 2014.

Dr Subir K Das

Work on Aging in Ferromagnetic Domain Coarsening (JPCM 26, 452202 (2014)), with J. Midya and S. Majumder, was included in IOP select, a special collection of journal articles, as well as appeared as a news item on Journal of Physics: Condensed Matter website.

Dr Sebastian C Peter

Young and Outstanding Scientist in Solid State Chemistry by the American Chemical Society (ACS)

Dr Ranjani Viswanatha

INSA Young Scientist Award -2014

Dr T N C Vidya

Nominated by INSA to represent the country as a Young Leader at the Young Leaders' Programme, which was part of the Annual Meeting of the Science and Technology in Society Forum. This meeting was held in Kyoto, Japan, from October 5-7, 2014.

Dr Ujjal Gautam

The Most Influential Scientific Minds 2014 by Thomson Reuters

Prof C P Rajendran

His work on Himalayas published in Science Magazine and broadcast on Rajya Sabha TV

Prof U Varshney

G N Ramachandran Gold Medal for Excellence in Biological Sciences & Technology, 2014 (CSIR).

Prof Partha P Majumder

Lifetime Achievement Award, 2014: Society of Biotechnologists' M.V. Pylee Lifetime Achievement Award for Original Contributions to Biotechnology

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

Supporting Staff

Mr Sachin Belvadi received Yuva Prashasthi 2014

Awards to JNCASR

JNCASR has bagged the 1st prize for the Best Maintained Garden for the year 2014 instituted by the Mysore Horticultural Society, Lalbagh, Bangalore.

JNCASR has bagged 1st prize for the Best ornamental/vegetable garden instituted by the Mysore Horticultural Society, Lalbagh, Bangalore.

NDTV Design and Architecture Award under the Institutional Architecture Design of the Year for Education category for designing the CCMS Laboratory of the Centre

AWARDS RECEIVED BY STUDENTS

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

Mr Mohit Kumar (Ph D student, New Chemistry Unit; 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.

Mr Chandradhish Ghosh (Ph D student, New Chemistry Unit; Research Supervisor: Dr Jayanta Haldar) has been awarded the 2nd prize in Best Oral Presentation at the Fourth International Symposium on Antimicrobial Peptides held in Lorient, France during June 4-6, 2014.

Mr K Rajasekhar, Ph D student received Best Poster Award in recently held Indo-German Conference on Bioinspired Chemistry (IGCBIC-2014) held at Indian Institute of Science (IISc), Bangalore.

Polish Society for Microscopy (PTMi) Award in the Ph D students' contest of XV International Conference on Electron Microscopy, EM'2014, Krakow, Poland conferred to **Mr Dileep Krishnan** (Ph D student, Chemistry and Physics of Materials Unit; Research Supervisor:) for the contribution on probing nanoscale variation of optical properties of NiCo₂O₄, NiFe₂O₄, and CoFe₂O₄ by HREELS.

Ms Debabrata Maity (Ph D student, Bioorganic Chemistry Laboratory, New Chemistry Unit, Research Supervisor: Dr T Govindaraju) received 1st Prize of 2014 Lilly Outstanding Thesis Award.

Dr Mohit Kumar (Ph D student, New Chemistry Unit, Research Supervisor: Dr Subi J George) awarded Best Poster prize in the 8th Asian Photochemistry Conference held during November 10-13, 2014.

Mr Uttam Gupta (Ph D student, Chemistry and Physics of Materials Unit; Research Supervisor: Prof C N R Rao) awarded Best Poster prize in the 8th Asian Photochemistry Conference held during November 10-13, 2014.

Mr Chandradhish Ghosh (Ph D student, New Chemistry Unit; Research Supervisor: Dr Jayanta Haldar) received Gandhian Young Technological Innovation (GYTI) appreciation award" under "SRISTI Technological Edge/Strategic innovation" category at Rashtrapathi Bhavan, New Delhi.

Mr Venkateswarlu Yarlagadda (Ph D student, New Chemistry Unit; Research Supervisor: Dr Jayanta Haldar) has been awarded the Biotechnology Industry Research Assistance Council (BIRAC) - Gandhian Young Technological Innovation (GYTI) Award under SRISTI Technological Edge/Strategic innovation category at Rashtrapathi Bhavan, New Delhi.

Mr Satya Narayan Guin (Ph D student, New Chemistry Unit, Research Supervisor: Dr Kanishka Biswas) has been awarded best poster prize in the 17th Chemical Research Society of India (CRSI) National Symposium in Chemistry held at National Chemical Laboratory, Pune during February 5-8th



2015.

Mr Umesh Mogera (Ph D student, Chemistry and Physics of Materials Unit, Research Supervisor: Prof G U Kulkarni) has been awarded Nanoscale Poster Prize at Nano India-2015 held during January 29-30, 2015 in SASTRA University, Thanjavur.

RAK-CAM Sheikh Saqr Junior Fellowships were awarded to **Mr K Gopalakrishnan** and **Mr S R Lingampalli** of Chemistry and Physics of Materials Unit.

FELLOWSHIPS

Prof Anuranjan Anand

Fellow of National Academy of Sciences, Allahabad

Prof S Balasubramanian

Sheikh Saqr RAK CAM Senior Fellowship, 2014

Dr Kanishka Biswas

Associate of Indian Academy of Sciences

Dr Subi J George

Sheikh Saqr Career Award Fellow (2014)

Dr T Govindaraju

Sheikh Saqr Career Award Fellow (2014)

Prof G U Kulkarni

Fellow of the National Academy of Sciences, Allahabad

Fellow of the Indian Academy of Sciences, Bangalore

Prof Tapas K Kundu

Received the first Silver Jubilee Professorship donated by the C N R Rao Education Foundation

Dr Tapas K Maji

Humboldt Fellowship for Senior Researchers (2015-2017)

Prof K S Narayan

J C Bose Fellowship, 2015

Prof Swapan K Pati

Fellow of the The World Academy of Sciences (TWAS), 2014.

Prof M R S Rao

SERB Distinguished Fellow

Prof Srikanth Sastry

J C Bose Fellowship 2015

Prof K B Sinha

SERB Distinguished Fellow

Prof Umesh V Waghmare

J C Bose National Fellowship

Fellow of the INSA

MEMBERSHIPS/APPOINTMENTS

Prof C N R Rao

Honorary Foreign Member of the Chinese Academy of Sciences
Corresponding Member of the Australian Academy of Sciences
Honorary member of the Nepal Academy of Science and Technology

Prof Amitabh Joshi

Member, Sectional Committee on Animal Sciences, Indian National Science Academy, New Delhi.
Member, Research Advisory Committee, Indian Institute of Science Education and Research, Thiruvananthapuram (IISER-TVM).

Prof Tapas K Kundu

Vice-President of The Society of Biological Chemists (India)

Prof Maneesha Inamdar

Member, Steering Group, International Stem Cell Banking Initiative of ISCF.

Prof Umesh V Waghmare

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

Prof Kaustuv Sanyal

Fellow of the National Academy of Sciences
Invited Member of the Advisory Board of the 21st International Chromosome Conference, Brazil

Prof N S Vidhyadhiraja

Adjunct Faculty at Department of Physics and Astronomy, Louisiana State University

Prof V Nagaraja

President Elect, Indian Society of Cell Biology (2015-16)

Prof Govindan Rangarajan

Member, National Board for Higher Mathematics.
Member, Governing Board, Centre for Brain Research.

Prof Partha P Majumder

Elected Member, 2014: International Statistical Institute, The Hague, The Netherlands

EDITORIAL BOARDS

Prof Meheboob Alam

Editorial Board Member of Proceedings of Mathematical Sciences (Indian Academy of Science; co-published with Springer) and Scientific Reports (Nature Publishing Group, London)

Prof Maneesha Inamdar

Editorial Board Member, Scientific Reports, Nature Group Publications.

Dr Kavita Jain

Co-editor of the international journal EPL (Europhysics Letters)

Dr Tapas K Maji

Editorial Board Member of Scientific Reports, a journal from Nature Publishing Group

Prof Shobhana Narasimhan

Member, Editorial Board, Nature Scientific Reports
Member, International Program Committee, Psi-k



Prof Vijay Kumar Sharma

Editorial Board Member of the journal Current Science, Indian Academy of Sciences, Bangalore.
Editorial Board Member of the Journal of Circadian Rhythms, Ubiquity Press, London.

Prof Umesh V Waghmare

Editor of Pramana-The Journal of Physics, published by Indian Academy of Science, Bangalore

Prof Sathyamurthy

Member, Editorial Board, Current Science, 2015-

Prof Raghavan Varadarajan

Associate Editor (2015-2017) of Journal Proteins: Structure, Function, Bioinformatics,

FINANCIAL STATEMENTS

Name : JAWAHARLAL NEHRU CENTRE FOR
ADVANCED SCIENTIFIC RESEARCH

Address : Jakkur Post, Bangalore - 560 064

Year Ended : 31st March 2015

Assessment Year : 2015-16



FINANCIAL REPORT



G.R. VENKATANARAYANA

CHARTERED ACCOUNTANTS

Partners :

CA. G.R. Venkatanarayana, B.Com., F.C.A.,

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CA. Venugopal N. Hegde, B.Com., F.C.A.,

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AUDITORS' 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, 2015 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 auditors' 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 auditors consider 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 read alongwith the notes forming part of the accounts, give a true and fair view;

- i) In the case of Balance sheet, of the state of affairs of the entity as at March 31, 2015; and
- ii) In the case of Income and Expenditure account, of the excess of income over expenditure 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 far 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 granting the funds.

For M/s G R Venkatanarayana
Chartered Accountants



(G R Venkatanarayana)
Partner

Membership No. 018067
Firm Regn. No. 004616S

Place : Bangalore
Date : 21.09.2015

M/s. G.R. VENKATANARAYANA
Chartered Accountants
012, 75th Cross, 6th Block
Rajajinagar, BANGALORE-560 010



**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
BALANCE SHEET AS AT 31st MARCH 2015**

Description	Schedule	Current year	Previous year
		2014-15 Rs.	2013-14 Rs.
LIABILITIES			
Corpus/Capital Fund	1	2,298,792,268.05	2,171,760,759.32
Reserves & Surpluses	2	(50,014,036.28)	(55,521,186.07)
Earmarked and Endowment Funds	3	245,467,567.83	274,209,045.83
Secured loans and Borrowings	4		
Unsecured loans and Borrowings	5		
Deferred Credit Liabilities	6		
Current Liabilities and Provisions	7	26,138,376.02	27,899,880.37
Other funds-Cluster Studies		39,541.00	39,541.00
Scheme Balances		267,986,630.43	136,541,685.46
Total		2,788,410,347.05	2,554,929,725.91
ASSETS			
Fixed Assets (gross)	8	2,298,792,268.05	2,171,760,759.32
Investments-Endowment Funds	9	223,001,170.00	271,166,737.00
Investment - Others	10	0.00	0.00
Current Assets, Loans, Advances etc.	11	266,616,909.00	112,002,229.59
Total		2,788,410,347.05	2,554,929,725.91
Significant accounting policies	24		
Contingent Liabilities & Notes on Accounts	25		

Schedule 1 to 25 are integral part of Accounts

**For Jawaharlal Nehru Centre for
advanced Scientific Research**

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

For M/s G R Venkatanarayana
Chartered Accountants




[G.R.VENKATNARAYANA]
Partner

Membership No. 018067

Place : Bangalore, Dated: 21.09.2015

IA/s. G.R. VENKATANARAYANA
Chartered Accountants
61B, 75th Cross, 6th Block
Rajajinagar, BANGALORE-560 010


R.S.Gururaj
Account in charge



Prof.K.S.Narayan
President in charge



A.N.Jayachandra
Sr.Administrative Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 MARCH 2015**

Description	Schedule No	Current year	Previous year
		2014-15 Rs.	2013-14 Rs.
Income			
Income from services	12	0.00	0.00
Grants/Subsidies received	13	534,597,000.00	562,408,000.00
		534,597,000.00	562,408,000.00
Less: Extent of fixed assets procured		127,031,508.73	223,023,080.00
		407,565,491.27	339,384,920.00
Add: Proceeds of sale of fixed assets		0.00	0.00
		407,565,491.27	339,384,920.00
Income from Fees/Subscriptions etc	14	1,933,880.00	1,622,426.00
Income from Investments	15	0.00	0.00
Royalty Income, Publication, Licence fee etc	16	758,858.22	1,639,628.34
Interest earned	17	17,579,306.00	16,876,977.00
Other income	18	83,524,196.00	31,620,679.00
Increase/decrease in stocks	19		
Total		511,361,731.49	391,144,630.34
Expenditure			
Establishment expenses	20	263,601,891.00	218,417,024.00
Other administrative expenses	21	242,206,205.70	205,601,337.73
Expenditure on Grants, Subsidies etc	22	0.00	0.00
Interest & bank charges	23	46,485.00	35,472.88
Total		505,854,581.70	424,053,834.61
Excess of Income over expenditure		5,507,149.79	(32,909,204.27)
Balance brought forward		(55,521,186.07)	(22,611,981.80)
Balance carried to Balance sheet		(50,014,036.28)	(55,521,186.07)
Significant accounting policies (Enclosed)	24		
Contingent Liabilities & Notes on Accounts	25		

Schedule 1 to 25 are an integral part of Accounts

**For Jawaharlal Nehru Centre for
advanced Scientific Research**

This is the Income and Expenditure account referred to in our report of even date.

For M/s G R Venkatanarayana
Chartered Accountants


[G.R.VENKATNARAYANA]
Partner

Membership No. 018067

Place : Bangalore, Dated: 21.09.2015

M/s. G.R. VENKATANARAYANA
Chartered Accountants
618, 75th Cross, 6th Block
Rajajinagar, BANGALORE-560 010



Prof. K.S. Narayan
President in Charge


R.S. Gururaj
Accounts in charge


A.N. Jayachandra
Sr. Administrative Officer



JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31.03.2015

OPENING BALANCES & RECEIPTS	2014-15 Rs	2013-14 Rs	2014-15 Rs	2013-14 Rs	2014-15 Rs	2013-14 Rs
I. Opening Balances:						
a. Cash in hand & Imprest at centre	134,088.00	68,826.00			259,765,377.00	216,500,037.00
b. Bank balances:					232,397,416.05	196,312,438.73
<i>In savings bank Accounts:</i>					4058298.00	4,057,998.00
Canara bank	3,000,144.13	8,615,603.05			496,221,081.05	416,870,473.73
Union Bank of India	175,103.00	168,304.00			0.00	0.00
SBI	142,881.00	1,729,686.00			0.00	0.00
<i>In Deposit accounts:</i>						
At Canara Bank	113,908,000.00	103,908,000.00				
At SBI	61,500,000.00	61,500,000.00				
At HDFC Trust	86,705,500.00	80,705,500.00			125,333,660.73	219,009,602.00
	265,585,716.13	256,695,919.05				
II. Grants Received:					96,781.00	0.00
From DST-Grant in aid	534,597,000.00	550,000,000.00				
From Govt agencies						
From other agencies						
On behalf of Endowments	6,500,000.00	10,008,000.00				
	541,097,000.00	562,408,000.00				
III. Income on Investments:						
A. Interest on FD's:						
a. From Earmarked/Endowment Fund	9,433,904.00	16,484,044.00				
b. From Own funds	4,827,874.00	14,179,240.00				
	14,261,778.00	30,663,284.00				
IV. Interest received:						
a. On Bank S.B A/c	1,751,432.00	2,697,737.00				
Balance Carried forward	822,675,926.13	852,464,940.05			621,611,532.78	635,915,548.61

JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31.03.2015 (Contd...)

	2014-15		2013-14		PAYMENTS & CLOSING BALANCES		2014-15		2013-14	
	Rs	Ps	Rs	Ps	Rs	Ps	Rs	Ps	Rs	Ps
OPENING BALANCES & RECEIPTS										
Balance Brought Forward	822,675,926.13		852,464,940.05		Balance Brought Forward		621,611,532.78		635,815,548.61	
V. Other Income:					VII. Other payments:					
a. Royalty	911,856.22		1,058,893.34		Earnest money deposit returned		0.00		459,500.00	
b. Licence Fee	1,230.00		0.00		Staff advances (Festival adv etc.)		648,000.00		720,000.00	
					refund to projects		37,500,000.00		75,007,829.00	
c. Collections from Visitors, Guest room etc	1,945,929.00		2,292,926.00		Other advances		0.00		27,291,912.65	
					Security deposit returned		0.00		1,904,032.00	
d. From fee subscription etc	481,782.00		703,637.00		TDS Payments		0.00		0.00	
e. CSIR fellowships, UGC, DBT reimbursements	15,117,533.00		18,332,811.00		Advances with faculty		3,815,532.00		3,844,645.00	
f. Overhead recoveries	20,000,000.00		8,000,000.00		Payment to sundry creditors		108,155,520.85		1,661,662.00	
g. From corpus										
h. From others	2,180,722.00		667,349.00							
	40,649,052.22		31,055,616.34		VIII. Closing Balances:					
VI. Amount received from projects	30,000,000.00		37,500,000.00		a. Cash in hand & Imprest at centre		387,733.00		134,088.00	
					b. Bank balances:					
VII. Other receipts:					<i>In savings bank accounts at:</i>					
Income tax refunds	744,876.00		60,560.00		Canara Bank		23,714,947.57		3,000,144.13	
From Sundry Creditors	10,173,349.19		14,334,846.00		Union Bank of India		182,177.00		175,103.00	
Staff advances recovered	3,000.00		5,000.00		State Bank Of India		220,082.00		142,881.00	
Settlement of advance to faculty	45,908.00		32,869.00		<i>In deposit accounts at:</i>					
Earnest money received	0.00		28,600.00		At Canara Bank		56,967,000.00		113,908,000.00	
Project funding received	0.00		7,679,015.00		At SEBI		61,500,000.00		61,500,000.00	
GSLI receipt	3,519.00		0.00		At HDFC Trust		86,705,500.00		86,705,500.00	
Support to meetings	5,087,400.00		0.00							
TOTAL	1,001,388,025.20		1,012,370,845.39		TOTAL		1,001,388,025.20		1,012,370,845.39	

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

For M/s G R Venkatanarayana
Chartered Accountants

[G.R. VENKATNARAYANA]

Partner

Membership No. 018067

Place : Bangalore, Dated: 21.09.2015



(Signature)
Prof. K.S. Narayan
President in Charge

A.N. Jayachandra
Sr. Administrative Officer

(Signature)

R.S. Gururaj
Accounts in charge



JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
CPF & NPS FUND STATEMENT OF AFFAIRS FOR THE YEAR ENDED 31.03.2015

Particulars	Rs.	Rs.	Particulars	Rs.	Rs.
CONTRIBUTORY PROVIDENT FUND			INVESTMENT OF FUNDS :		
SUBSCRIPTION :			Investments in :		
Opening Balance	6,762,565.00		Government of India 8 % Bonds (SHCIL)	18,500,000.00	
Add : Subscriptions received during the year	3,397,933.00		Fixed Deposits at Canara Bank	20,652,633.00	
Loan repayments	4,685,205.00		Fixed Deposit at HDFC	50,000,000.00	89,152,633.00
Interest on subscriptions			Closing Cash and Bank Balance :		
Less: Loans granted during the year	5,018,441.00		Cash at Bank :		
Less: Final settlement	855,177.00		SB A/C No.17513		
Closing Balance		64,433,036.00	Canara Bank, IISc branch		
			Net Closing balance at Bank	11880890.87	11,880,890.87
CONTRIBUTION			TDS GOI Bonds (2013-14) receivable		148,000.00
Opening balance	2,799,014.00		TDS-GOI Bonds (2014-15) receivable		148,000.00
Add : Contribution during the year	3,344,757.00				
Interest on total contributions					
Less: Final settlement	934,138.00				
Closing Balance		45,076,016.00			
NEW PENSION SCHEME					
SUBSCRIPTION					
Opening Balance	80,551.00				
Total	80,551.00				
Withdrawal	0.00				
Closing Balance	80,551.00				
CONTRIBUTION					
Opening balance					
Total	74,482.00				
Withdrawal	74,482.00				
Closing Balance	0.00				
	74,482.00				
Total		109,664,085.00	Balance Deficit		867303.13
			Total		109,664,085.00

for Jawaharlal Nehru Centre for Advanced Scientific Research

For M/s G R Venkatanarayana
Chartered Accountants



[G.R. VENKATANARAYANA]
 Partner
 Membership No. 018067

(Signature)
Prof. K.S. Narayan
 President in charge

(Signature)
A.N. JAYACHANDRA
 Sr. Administrative Officer

(Signature)
R.S. Gururaj
 Accounts in charge

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


Description	2014-15	2013-14
	Rs.	Rs.
SCHEDULE 1- Capital Fund:		
Balance as at the beginning of the year	2,171,760,759.32	1,948,737,679.32
	2,171,760,759.32	1,948,737,679.32
Less : Depreciation up to the end of previous year	604,584,316.00	515,961,018.00
	1,567,176,443.32	1,432,776,661.32
Add : Addition to Fixed Assets during current year	127,031,508.73	223,023,080.00
	1,694,207,952.05	1,655,799,741.32
Less : Deletion to Fixed Assets during Current Year	0.00	0.00
	1,694,207,952.05	1,655,799,741.32
Less : Depreciation for the current year	94,316,091.00	88,623,298.00
	1,599,891,861.05	1,567,176,443.32
Add : Depreciation Reserve per contra	698,900,407.00	604,584,316.00
TOTAL	2,298,792,268.05	2,171,760,759.32
SCHEDULE 2- Reserves And Surpluses:		
General Reserve:		
Surplus/deficit In Income and expenditure Account	(50,014,036.28)	(55,521,186.07)
SCHEDULE 3- F earmarked / Endowment Funds:		
A : Infrastructure Corpus Fund		
Opening Balance	207,414,037.54	188,087,640.64
Additions during the year	14,821,112.00	19,326,396.90
Funds-Income from Investments made		
	222,235,149.54	207,414,037.54
Less : Support to Grant Accounts	50,000,000.00	0.00
Total : Infrastructure Corpus fund	172,235,149.54	207,414,037.54
B : Other funds		
Opening Balance of the Funds	66,795,008.29	65,150,161.18
Add : Additions :		
Funds/Donations/Grants/Royalties	8,173,206.00	30,000.00
Funds-Income from Investments made	3,995,708.00	5,266,575.11
	78,963,922.29	70,446,736.29
Less : Funds-utilisation/Expenditure incurred	5,731,504.00	3,651,728.00
Total : Other Funds	73,232,418.29	66,795,008.29
Grand Total - Infrastructure Corpus and Other Funds	245,467,567.83	274,209,045.83
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/Security Deposits	5,230,156.00	4,686,387.00
Sundry Creditors for others	20,908,220.02	23,213,493.37
TOTAL	26,138,376.02	27,899,880.37


 R.S. Gururaj
 Accounts in charge



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

Description	2014-15	2013-14
	Rs.	Rs.
SCHEDULE 8- Fixed Assets		
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 extrn to Hostel, College etc.,	11,883,626.00	11,883,626.00
Nano Science Block	7,042,909.00	7,042,909.00
Extension 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	50,148,316.00	48,187,253.00
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	10,333,669.38	10,186,569.00
Extension to HIV lab	1,016,085.00	1,016,085.00
Security Office Block	742,632.00	742,632.00
Animal House - Additional Block	8,292,632.00	8,292,632.00
Residential Quarters (Sr.AO)	3,659,034.00	3,659,034.00
Child Care Centre	728,827.00	728,827.00
Hostel Phase -IV	25,934,842.00	25,934,842.00
Extension 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	7,788,054.00
Visiting Students Hostel	33,982,070.00	33,982,070.00
Health Centre	3,243,422.00	3,243,422.00
Nano Institute Shivanapura	3,709,242.00	3,709,242.00
EOBU Lab block	20,911,646.00	19,263,812.00
Post-Doc Housing-Srirampuram	7,207,547.00	2,797,966.00
Material Science Lab Block	55,431,961.00	52,323,987.00
New Auditorium	11,869,596.00	4,945,649.00
Radio Active Lab-Type II	1,399,038.00	0.00
	533,535,996.64	513,939,459.26
Infrastructure Facilities:		
Roads, Streetlights, Dranages, partitions etc	93,562,366.32	91,972,607.32
Tubewells and water supply	248,912.00	248,912.00
	93,811,278.32	92,221,519.32
Plant/Machinery/Equipment:		
Scientific Equipments/Plant/Machinery	839,210,112.45	804,905,531.45
ICMS-Laboratory equipments & facilities	252,463,341.00	203,234,885.00
Equipments - Chemistry & Physics of Materials	74,041,456.00	74,041,456.00
	1,165,714,909.45	1,082,181,872.45
Others :		
Vehicles	2,703,373.00	2,703,373.00
Furniture and fixtures	71,485,500.87	67,569,794.87
Office equipment	20,056,041.41	20,017,235.41
Computer/peripherals	72,215,961.00	69,780,350.00
Electrical installations	112,738,560.00	112,738,560.00
Library Books	28,397,426.21	28,065,533.21
Library Journals	165,090,479.15	150,179,181.80
	472,687,341.64	451,054,028.29
Intangible Assets: Softwares	15,327,391.00	14,648,529.00
TOTAL	2,298,792,268.05	2,171,760,759.32
Less - Depreciation up to the end of previous year	604,584,316.00	515,961,018.00
Depreciation for the current year	94,316,091.00	88,623,298.00
Written down value of the assets as at the year end	1,599,891,861.05	1,567,176,443.32
Add - depreciation reserve per contra	698,900,407.00	604,584,316.00
TOTAL	2,298,792,268.05	2,171,760,759.32


R.S. Gururaj
Accounts in charge

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2014-15 Rs.	2013-14 Rs.
<u>SCHEDULE 9- Investments - Earmarked/Endowment Funds</u>		
<u>Long Term Deposits</u>		
Fixed Deposits with HDFC (Trust Deposits)	86,705,500.00	86,705,500.00
Fixed Deposits with Canara bank	56,967,000.00	113,908,000.00
Fixed Deposit with SBI	61,500,000.00	61,500,000.00
Interest accrued on Fixed Deposits with banks / HDFC	17,828,670.00	9,053,237.00
TOTAL	223,001,170.00	271,166,737.00
<u>SCHEDULE 10- Investments - Others</u>		
<u>Short Term Deposits - SCHEMES</u>		
	0.00	0.00
TOTAL	0.00	0.00
<u>Schedule 11 Current Assets, Loans, Advances etc.,</u>		
<u>Cash & Bank Balances (Schemes)</u>		
Cash in hand - Schemes Account	98,790.00	1,643.00
Cash at Bank -Schemes - Canara Bank	52,887,840.43	34,040,042.46
Fixed deposit with Canara Bank (Schemes)	185,000,000.00	65,000,000.00
	237,986,630.43	99,041,685.46
<u>Cash & Bank Balances - Centre</u>		
Cash in hand Grant Account	317,568.00	119,162.00
Cash in hand Endowment Account	50,165.00	14,926.00
Cash at Bank - Canara Bank - Grants	6,492,555.64	102,674.20
Cash at Bank - Canara Bank - Endowments	17,222,391.93	2,897,469.93
Cash at Bank - Union Bank	182,177.00	175,103.00
Cash at Bank - SBI	220,082.00	142,881.00
	24,484,939.57	3,452,216.13
<u>Loans and Advances</u>		
Advances to staff	422,619.00	1,314,699.00
Other advances & Receivables	703,144.00	5,028,217.00
TDS receivable	2,995,104.00	3,165,412.00
Imprest Balance	24,472.00	0.00
	4,145,339.00	9,508,328.00
TOTAL	266,616,909.00	112,002,229.59


 R.S. Gaur
 Accounts in charge



JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2014-15	2013-14
	Rs.	Rs.
SCHEDULE 12-Income from sales / services	0.00	0.00
	0.00	0.00
SCHEDULE 13-Grants/subsidies :		
Grants - DST	534,597,000.00	550,000,000.00
Grants - From Government agencies/Travel grants etc.		8,000.00
Grants - From other Institutes		10,000,000.00
Grants - Other international agencies		2,400,000.00
TOTAL	534,597,000.00	562,408,000.00
SCHEDULE 14-Income from Fee/Subscriptions etc :		
Income from fee, subscriptions,medical contribution etc.,	1,933,880.00	1,622,426.00
TOTAL	1,933,880.00	1,622,426.00
SCHEDULE 15-Income from investments;	0.00	0.00
SCHEDULE 16-Royalty Income,Publication,Licence fee etc :		
From Royalty	620,403.22	1,462,539.34
Licence fee	138,455.00	177,089.00
TOTAL	758,858.22	1,639,628.34
SCHEDULE 17-Interest earned:		
From Term deposits	15,827,874.00	14,179,240.00
From SB accounts with nationalised banks	1,751,432.00	2,697,737.00
TOTAL	17,579,306.00	16,876,977.00
SCHEDULE 18-Other income:		
From Visitors house,Guest rooms,Students residence etc,	4,247,473.00	4,291,824.00
CSIR Fellowships, ICMS, SRFP reimbursement etc.,	15,117,533.00	18,332,811.00
Overhead recoveries	9,000,000.00	8,000,000.00
Support from JNC Corpus	50,000,000.00	0.00
From others(tender fee & other fee collected)	1,017,026.00	996,044.00
Other Receipts (Uncashed Cheques reversed)	4,142,164.00	0.00
TOTAL	83,524,196.00	31,620,679.00
SCHEDULE 19 - Increase / Decrease in stock:	0.00	0.00


 R.S. Gurung
 Accounts in charge

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

Description	2014-15	2013-14
	Rs.	Rs.
SCHEDULE 20- Establishment expenses:		
Salaries & Scholarship to students	183,462,695.00	163,970,429.00
Wages	58,395,633.00	38,298,575.00
Allowances (Medical reimbursements etc.,)	7,428,874.00	5,558,176.00
Bonus	279,391.00	263,057.00
Contribution to CPF	3,553,015.00	2,643,418.00
Contribution to new Pension Scheme	3,716,036.00	3,562,799.00
Contribution to Group Gratuity Scheme	1,500,000.00	1,500,000.00
Leave Encashment Benefits	897,355.00	364,835.00
Retirement & Terminal Benefits	2,801,907.00	1,266,445.00
LTC	1,566,985.00	989,290.00
TOTAL	263,601,891.00	218,417,024.00
SCHEDULE 21- Other Administrative expenses		
Electricity & Power	53,849,099.00	40,023,743.00
Water charges	4,580,521.00	5,362,157.00
Insurance	732,753.00	617,378.00
Repairs & Maintenance	40,634,393.00	34,779,375.00
Rents, Rates & Taxes	842,329.00	2,367,586.00
Vehicles Running & Maintenance	6,315,438.00	7,351,594.00
Postage, Telephone & Communication	6,682,422.00	3,625,713.00
Printing, stationery, Books	5,069,699.48	5,749,447.00
Travelling and conveyance	3,513,233.00	5,062,609.00
Expnses on Seminars/workshops/discussion meetings	12,672,974.50	10,888,908.97
Membership & Subscriptions	495,019.00	565,634.00
Professional charges	14,015,036.00	11,557,824.00
Laboratory Consumables	45,771,398.72	55,035,767.76
Frieght Inwards	2,149,262.00	1,926,662.00
Other Consumables	1,215,497.00	2,726,251.00
Advertisement & Publicity	3,720,479.00	2,087,796.00
Other miscellaneous expenses	2,899,878.00	2,374,188.00
Statutory Audit fee	56,180.00	56,180.00
POBE & POCE prgramme	1,213,037.00	1,144,055.00
Summer Research Fellowship Programme	1,954,728.00	508,578.00
ICMS - Workshops, Schools etc.,	1,684,991.00	892,733.00
ICMS - Visitor Programmes (National & International)	381,500.00	689,146.00
ICMS - Recurring Expenses	8,645,200.00	5,449,657.00
ICMS - Scientists & Supporting Staff	5,466,788.00	4,758,355.00
Commonwealth Meeting	17,644,350.00	0.00
TOTAL	242,206,205.70	205,601,337.73
SCHEDULE 22-Expenditure on grants, subsidies Etc:	0.00	0.00
SCHEDULE 23- Interest and Bank charges:	46,485.00	35,472.88
TOTAL	46,485.00	35,472.88

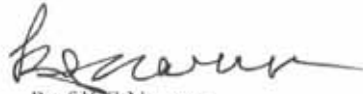

 R.S. Gumber
 Accounts in charge



SCHEDULE NO.24
Accounting Policies for the year 2014-15.

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 in charge


Prof.K.S.Narayan
President in charge

Place : Bangalore
Date : 21.09.2015


A.N. Jayachandra
Sr. Administrative Officer

For M/s G R Venkatanarayana
Chartered Accountants


(G R Venkatanarayana)
Partner
MembershipNo.18067


M/s. G.R. VENKATANARAYANA
Chartered Accountants
618, 75th Cross, 6th Block
Rejainagar, BANGALORE-560 010

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Schedule forming part of the accounts

SCHEDULE 25

A. Contingent Liabilities :	2014-15	2013-14
	Rs.	Rs.
1. Claims against the entity not acknowledged as debts	Nil	NIL
2. Letter of credit outstanding	Nil	NIL
B. Notes on Accounts :		
1. Estimated amount of contracts remaining to be executed on capital account and not provided for.	NIL	NIL


R.S. Gururaj
Accounts in charge





Science teachers award, June 30, 2014

*V Ramalinga Swami Memorial Lecture,
July 11, 2014
Speaker: Prof. Siddhartha Roy*



*MD@50, International Conference organized
by Prof Michael Klein, Temple University,
Philadelphia and Prof S. Balasubramanian,
JNCASR, August 25-28, 2014*

*JNCASR - Purdue University
Meeting, March 20-21, 2015*





JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
(A Deemed to be University)

Jakkur, Bengaluru – 560 064

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