

Annual Report 2015-16



Picture Courtesy:

Main pictures on the cover are related to the following CEFIPRA project numbers 4705-1; 4907-1; 5304-1; 5404-1; 5005-2; 5203-2 and 5105-3 implemented under Collaborative Scientific Research Programme



Indo-French Centre for the Promotion
of Advanced Research
(IFCPAR)

Centre Franco-Indien pour la Promotion
de la Recherche Avancée
(CEFIPRA)

Annual Report
2015-16

From the Director's Desk



I am pleased to present the Annual Report of the Indo-French Centre for the Promotion of Advanced Research (IFCPAR / CEFIPRA) for the year 2015-2016. The financial year 2015-2016 was successful and productive year in terms of accomplishment of annual activities and projecting CEFIPRA as an important stakeholder in Indo-French knowledge innovation value chain. CEFIPRA has continued its tradition of strengthening the Indo-French Science, Technology and Innovation system by supporting various research and development projects addressing the local and global issues. CEFIPRA has been effectively taking steps in promoting Industry-Academia linkages as a part of its Industrial Research and Development Programme. To create effective Public Private Partnerships (PPPs), CEFIPRA under Innovation Programme is playing a role either as facilitator or collaborator successfully in implementing the programme. During the year, CEFIPRA and the Airbus Group joined hands by signing a MoU, to launch a programme to support collaborative research projects in mutually identified areas.

CEFIPRA's scientists and students mobility programme has made significant contribution in terms of futuristic network, enhancing the overall scientific knowledge base and broaden the research horizons. To get the feedback of Raman-Charpak Fellowship (RCF) programme 2014, a debriefing session with the RCF fellows was organised in CEFIPRA on 12th January, 2016. During the year, the Centre has conducted eleven

seminars/workshops in vivid areas of S & T like Catalysis for Green and Sustainable Chemistry, Guided-Drug-Design, 3D Printing, Smart Systems and Structural Health Monitoring (SHM) for Structures under Harsh Environments, Nanoscaled Systems for Energy Harvesting etc.

This year CEFIPRA witnessed three Agreements/MoUs signed between Indian and French academic / research institutes & industries by hosting a ceremony at its premises during the State visit by H.E. the President of France to India in January, 2016.

CEFIPRA had the privilege to organize a visit by the Hon'ble Union Minister of India for Science & Technology and Earth Sciences, Dr.Harsh Vardhan on 4th March, 2016 to the Centre. The purpose of the visit was to meet & address the members of Governing Body. The Hon'ble Minister also released the Annual Report for 2014-15 & Newsletter "ENSEMBLE" (January-February, 2016) of CEFIPRA.

I would like to extend my gratitude to all those associated with CEFIPRA and its activities with a hope for greater opportunities and bigger success for further strengthening of Indo-French cooperation through Centre's role in developing stronger ties in S,T & I between the two countries.



Dr. Mukesh Kumar
Director, CEFIPRA

Contents

1.	Overview & Activities of the Centre	1-9
2.	Governance & Guidance	11-16
3.	Seminars/Workshops & Outreach	17-32
4.	Dedicated Mobility Support Programmes	33-41
5.	Brief Reports of Research Projects	
	A. Collaborative Scientific Research Programme	43-122
	B. High Impact Scientific Research Network Programme	123-125
	C. Industry Academia Research & Development Programme	127-136
	D. Targeted Programmes	137-155
	E. Innovation Programme Through Public Private Partnerships	157-163
6.	Analysis of Scientific Activities	165-175
7.	Mobility Support to Scientists & Students under Research Projects	177-189
8.	Indian and French Organizations	191-194
9.	Financial Reports & Audited Accounts	195-219



I. Overview & Activities of the Centre

Overview & Activities of the Centre during 1st April, 2015 to 31st March, 2016

CEFIPRA, India's first and France's only bilateral Centre to support collaborative research in the advanced areas of S&T has emerged as an enabler & facilitator of Indo-French S&T Cooperation with programme profile across the knowledge innovation chain. CEFIPRA established 29 years ago and has been proved to be an instrument of high quality research in both countries. During the year, CEFIPRA has started various new initiatives/ activities in accordance with changed scenario of global scientific landscape with emphasis on innovation, which has developed strong linkages between scientific communities of the two countries.

Scientific Collaborative Research Programme and Projects

The 55th & 56th Scientific Council (SC) meetings were organised from 28-30 May, 2015 at Nice, France & 14-16 November, 2015 at Bangalore, India, respectively.

Under the Collaborative Scientific Research Programme, seventeen new projects commenced in FY 2015-16. These were in domains of Pure and Applied Physics, Computer Science, Materials Science, Life and Health Sciences, Pure and Applied Chemistry, and Biotechnology. Besides these new projects, CEFIPRA continued supporting fifty ongoing scientific projects. Mobility of sixty-five scientists and 36 students between the two countries was supported. Twenty completed projects during the year have outcome in form of development of resources like libraries, new methods, data collection, etc. During the year, 116 publications in SCI journals were reflected as global scientific output.

Industry-Academia Research and Development Programme and Projects

The 26th and 27th Industrial Research Committee (IRC) meetings were held on 1st June, 2015 at Nice, France and 17th November, 2015 at Bangalore, India, respectively.

Knowledge-Product pathway had been catalysed through six ongoing projects in the areas of Intelligent Transport System, Health Science, Information Technology, Green Technology, Chemistry and Genomics under the Industrial Research Programme (IRP). Additionally, two projects one each in automation systems and aerospace were recommended for support during the year. The Governing Body and Industrial Research Committee of CEFIPRA directed the Centre to update the Industrial Research Programme of CEFIPRA in view of the changing scenario of global scientific landscape with emphasis on innovation. Accordingly, CEFIPRA revised the name of IRP as "Industry-Academia Research & Development Programme". The focus is to provide support for manpower for small industries i.e. SME, MSME and Start up and partial or full support (depending upon the cost of the technology) for technology acquisitions for enhancing industrial competitiveness of both the countries. During the FY 2015-16, apart from regular call for pre-proposal in all the areas of interest to the Indian & French Industries, CEFIPRA invited special call for pre-proposal in the following areas: • Additive manufacturing, • Robotics • Affordable Medical Devices. Call was launched for submission with deadline as 21st May, 2015.

Seminars/Workshops

The bilateral knowledge space had been further catalysed through supporting eleven seminars/workshops/training schools in the areas of Device Modelling, Nanotechnology, Materials Science, Catalysis, Structural Health Monitoring, etc. Of which, Indo-French workshop/school on "Emerging trends in electron device modelling" at IISc,

Bangalore & another "France India symposium on correlated oxide materials (FISCOM)" at Université de Montpellier, Montpellier were supported as a follow-up of completed projects supported by CEFIPRA. Through eleven seminars, the Centre brought more than four hundred scientists/students/researchers from India and France together to share the knowledge in the advanced areas for planning of future collaboration.

Targeted Programme

The Centre has continued to offer a platform to the national funding agencies to come together and support collaborative scientific research in focussed/targeted areas of mutual interest. The following Targeted Programmes expanded the mandate of CEFIPRA across the knowledge innovation chain.

- a) **DST-ANR** The projects were funded by DST in India and by ANR in France. Six projects are ongoing in the areas of infectious diseases; engineering sciences and neurosciences.
- b) **DST-Inria-CNRS** Eight projects are ongoing in the scientific areas of high performance computing, big data analytics, internet of things (with focus on smart cities), artificial intelligence, machine learning. During the year, 3rd Call for Proposals was launched in the areas of Distributed and Autonomous Systems, Machine Learning & Cybersecurity. A total of 14 proposals were received and 5 (3 with CNRS & 2 with Inria) were selected for support.
- c) **DST-INRA** The programme focuses on the area of integrated water management in agriculture in the context of climate change. Currently the project on "Adaptation of irrigated agriculture to climate change" is being implemented under this targeted programme. All the programmes were reviewed by the partners and appreciated the Centre for its effective implementation.

High Impact Scientific Research Network Programme

The Centre has been traditionally associated with bridging of individual scientists of two countries in collaborative mode. In order to harvest the strength of the network, CEFIPRA launched High Impact Scientific Research Network Programme in the areas of mutual interest in Science & Technology between India and France with special emphasis in the areas of Optics, Nano Sciences, Cold Atoms, Synchrotron Science, Computer Science & Bio-informatics, Energy Storage Devices, Metabolic Disorders and Infectious Diseases. Two projects were recommended for support; one each in the area of Health Science and High Energy Physics.

Dedicated Mobility Support Programme

In order to strengthen the supply chain of human resource and skill enhancement across the knowledge innovation chain, under the already existing programme, the Centre has three mechanisms as below.

Raman-Charpak Fellowship - The programme aims at improving the doctoral skills of Indian and French students by providing them an opportunity to carry out part of their research work in a University / Research Institute based in France or India, respectively. During the year 2015-16, visits of fifteen Indian and five French fellows were supported to the host institutions in France and India, respectively. This is a popular student mobility programme between the two countries.

CEFIPRA - European School on Nanoscience and Nanotechnology (ESONN) Fellowship – ESONN is three weeks fellowship programme aimed at providing training for doctoral, junior scientists. The Centre supported the participation of eight Indian doctoral students in 12th Edition of ESONN programme held during 23rd August- 12th September, 2015 at Grenoble, France.

CEFIPRA-SOLEIL Synchrotron - India and France would like to utilise large scale scientific facilities available within these two countries. In this context, the Centre facilitates the Indian scientists access to large research facilities of the SOLEIL Synchrotron (beam-time) in Saclay, France. Under this programme, the Centre supported visits of seventeen scientists/ researchers to SOLEIL facility in year 2015-16.

Public Private Partnership (PPP) Programme

Under the Innovative Programmes through Public Private Partnerships (PPPs), the following two programmes are ongoing:

CEFIPRA-SGRI Programme

CEFIPRA–Saint Gobain Research India (SGRI) Programme on “Sustainable habitat for hot and or humid climates” is the first initiative under the innovation programme. Currently, four projects are ongoing involving institutes like IIT Delhi, IIT Madras & IIIT Hyderabad. First year of projects was completed in early 2016.

Airbus Group-CEFIPRA Aerospace Programme

The CEFIPRA and the Airbus Group signed a MoU on 26th May, 2015 in France to launch “The Airbus Group-CEFIPRA Aerospace Programme” in the areas of (a) Applied Mathematics, Machine Learning and High Performance Computing; (b) Materials and Structures: Composite Materials based on Nanotechnology and also SHM (Structural Health Monitoring) by using NDA (Non Destructive Analysis methods) and (c) Avionics: Miniaturization of Smart systems based on MEMS/NEMS and in general Micro and Nanotechnologies. The call for pre-proposals was launched in July, 2015 & ten pre-proposals were received. Afterwards, five were recommended for submission as full proposals by Joint Experts Committee including a member of the Industrial Research Committee of CEFIPRA.

BIRAC-CEFIPRA-French Embassy

The BIRAC, CEFIPRA and French Embassy in India had launched an Indo-French Challenge oriented programme in the area of Red Biotechnology up to pre-commercialization stage in 2 + 2 model. The areas for collaboration were molecular diagnostics for prediction of diseases like Cardiac, Alzheimer, Cerebral Palsy and Generation of New Assistive Technologies for Mobility of Physically Challenged. Two projects are ongoing both in the area of Cardiovascular Diseases. Second call was launched in October, 2015 in the areas of Molecular Diagnostic for Prediction of Alzheimer’s and other Dementia, New technologies for Mobility of Physically Challenged and Biomaterials and Cell Engineering for Health Applications.

BIRAC-CEFIPRA-Bpifrance

Under the programme, CEFIPRA had launched Indo-French Health Technology Programme in association with Bpifrance and BIRAC in the area of Red Biotechnology upto pre-commercialization stage. The call for proposal was launched in November, 2015 in the areas of Digital Healthcare (e-health, tele-care, health IT, m-health, etc.) and Individualized Medicine (therapeutic solutions for individual patients, pharmacogenetics, etc.)

Outreach Programme

CEFIPRA conducted an outreach programme on 2nd June 2015 in Nice, France with an aim to reach and create more awareness about different activities of CEFIPRA supporting Indo-French Science and Technology system. The programme was attended by representative from Department of Science and Technology, Government of India, several Principal Investigators of CEFIPRA supported projects and research community. The session was aimed towards showcasing results of CEFIPRA’s intervention across knowledge innovation value chain & to spread awareness about Indo-French collaboration in different fields and opportunities through CEFIPRA. In addition to Nice, another outreach session was held on 24th July 2015 at Institute of Advanced Study in Science & Technology, Guwahati, Assam, India with an objective to reach out to the scientific communities in this region. Approximately hundred scientists, technologist, students participated from different parts of the North East Region. Representatives from Scientific Council & Industrial Research Committee of CEFIPRA were invited along with representatives from Campus France Kolkata & Federation of Industry & Commerce of North Eastern Region (FINER). At the onset,

Health Science, Mathematical Science, Biodiversity and Ecosystem in traditional knowledge, Herbal Medicine, Sericulture (Muga Silk), Fragrant Material were identified for collaboration for North Eastern Region. CEFIPRA also participated in Open House Session on “India-EU funding opportunities” organized by INDIGO Policy on 17th December, 2015 in New Delhi.

Publications

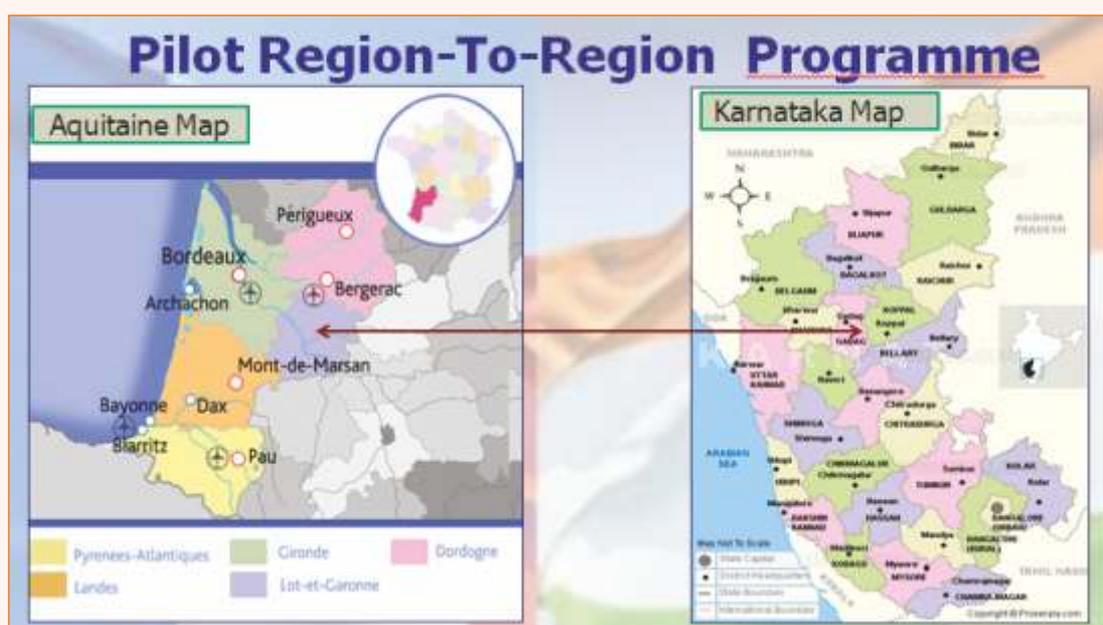
As per the practice, CEFIPRA has brought out a compilation (23rd Volume) of 115 research papers that have emanated from the projects supported under the programme. These papers have been published in Science Citation Index Journals with a high Impact Factor such as Nature, Nature Materials, Cell, Cancer Cell, Chemical Society, Nature Cell Biology, Advances in Physics, Molecular Cell, ACS NANO etc.

Indo-French Centre for Applied Mathematics (IFCAM)

IFCAM UMI 3494 was established in 2012 at Indian Institute of Science (IISc), Bangalore by the Department of Science and Technology (DST) in India and the Centre National de la Recherche Scientifique (CNRS) in France to build strong joint collaborations in Applied Mathematics at the interface with physics, computer science and engineering. CEFIPRA facilitated financial aspect and related visits of approximately twenty-five Indian scientists/students to France under seventeen ongoing projects.

Region-to-Region Programme: An Approach for Regional Collaborations

Region-to-Region Co-operation Programme was initiated by CEFIPRA to raise the level of cooperation between Indian and French Academia and Commercial entities on regional scale so as to develop mutually beneficial collaboration between the stakeholders. The programme was developed between Karnataka and Aquitaine regions of India and France, involving mobility of students and researchers, and for setting up discussion meetings and workshops in the framework of the region to region cooperation. The further modes & selection procedure were worked out. Both the regions have relatively better developed ST & I ecosystems which are thriving on the strong presence and performance of knowledge institutions as well as innovative enterprises in various domains, particularly benefitting from the policies at a regional level.



The programme has two distinct but closely linked pathways: The **Knowledge Cooperation** aimed to link the knowledge institutions of both the regions through various activities. **Business Cooperation** aimed to connect small and medium enterprises from both the regions in the areas of Aerospace and Biotechnology to develop B-2-B collaboration through several mechanisms.

As a follow-up of this programme, CEFIPRA was in contact with the representatives of IamSMEofIndia. Integrated Association of Micro Small & Medium Enterprises of India (MSMEs), popularly known as, IamSMEofIndia. Recently, IamSMEofIndia has submitted a draft proposal to CEFIPRA requesting for support to organize an Indo-French workshop for capacity building of Indian Small and Medium Sized auto component manufacturing units based in India towards preparing them to become strong suppliers in Aerospace industry under 'Make in India' initiative of Government of India. CEFIPRA and IamSMEofIndia representatives are in contact with the representatives of Aerospace Valley in France. Accordingly, a proposal for sending 4 students to the Aquitaine region from Karnataka region was agreed upon by CEFIPRA with the approval of Indian and French Co-Chairs. To develop the programme further, it was imperative that operational procedures need to be devised/ decided, following the best practices. In this context, the steps were proposed like mode and procedure of selection of students to be supported and total budget allocation for the activity and periodicity was decided.

Indo-French Water Network (IFWN) Programme

Considering the strong urge of the French and Indian Governments to reinforce scientific collaboration to address prevalent and emerging challenges in water, the French Embassy in India and the Department of Science & Technology (DST), India, joined hands for Indo-French scientific networking programme in the field of water. This networking programme has been implemented by CEFIPRA in the priority areas such as Waste Water Treatment (Industrial/ Domestic) and Natural Water Treatment Systems. The programme objectives are following:

1. To form dedicated networks of Indian and French research groups & industries to address identified water issues.
2. To strengthen and expand the quality and potential of water research in both countries by building greater interaction between France and India.
3. To build stronger relationships between industry and academic communities in France and India coupled with better knowledge exchange, to form the basis for future collaborations, research projects, and joint endeavour related to water technology, research & innovations.

The projects supported must include at least two and not more than five partners on the Indian and French sides with at least one industrial partner and one academic partner must be involved in each project. Call for Proposal was launched in May, 2015 and two projects were selected and implemented.

Other Initiatives

Development of Conflict of Interest- Guidelines

During 57th Scientific Council (SC) meeting held from 17-20th May, 2016 at Tours, France, the SC had suggested that based on the existing guidelines for Conflict of Interest adopted by DST, DBT, CNRS and French Universities etc. CEFIPRA could also develop a criteria for Conflict of Interest for the Scientific Council of CEFIPRA as per its requirement.

For the Scientific Council (SC)/Industrial Research Committee (IRC) meetings, the CEFIPRA will obtain a written certification from all members that they have not participated in any reviews of applications when their presence would have constituted a real or apparent Conflict of Interest and that the confidentiality of actions will be maintained. Prior to the SC/IRC meetings, members will receive a form on which they must identify applications with which they

have a Conflict of Interest, if any and must certify that no Conflict of Interest exists with the remaining applications.

Hosting a signing ceremony for discussion on three Indo-French S&T Agreements/MoUs at CEFIPRA Office- 25th January 2016

CEFIPRA had a privilege to host a signing ceremony at its premises on 25th January, 2016 for discussions on Agreements/MoUs signed between the following Indian and French academic/research institutions and industries. The discussion was focussed on Agreements/MoUs signed in various sectors of higher education, research, mobility of students and personnel, workshops/conferences/summer schools etc.

1. The Agreement signed between the Indian Institute of Science Education and Research, (IISER) Pune and the Ecole Normale Supérieure de Lyon to contribute to the development of activities of training and research.
2. The Agreement signed between the Indian Institute of Technology-Bombay (IIT-B), Mumbai and French CNRS/Telecom Bretagne/ Université de Bretagne occidentale/Université de Bretagne Sud/ENSTA Bretagne/ENI Bretagne to promote academic and scientific exchanges and collaboration in areas of interest and benefit to all institutions.
3. The Memorandum of Understanding (MoU) for sponsored Ph.D. Fellowships signed between Thales and Indian Institute of Technology-Bombay (IIT-B), Mumbai.



Visit by Dr. Harsh Vardhan, Hon'ble Union Minister of India for Science & Technology and Earth Sciences

CEFIPRA had the privilege to organize a visit by the Hon'ble Union Minister of Science & Technology and Earth Sciences, Dr. Harsh Vardhan on 4th March, 2016 to the Centre. The purpose of the visit was to meet & address the members of Governing Body. The Hon'ble Union Minister also released the Annual Report for 2014-15 & Newsletter 'ENSEMBLE' (January-February, 2016) of CEFIPRA.

On this occasion, several officials from Department of Science and Technology, Ministry of External Affairs of Government of India; French Embassy in India and project collaborators of CEFIPRA projects were also present.

At the outset, Director, CEFIPRA welcomed the Hon'ble Minister to the office of CEFIPRA. Director, CEFIPRA made a presentation about the activities of CEFIPRA and described different models to implement the joint research projects by Indian and French collaborators under various programmes of CEFIPRA.

The Hon'ble Minister addressed the gathering on this occasion. He welcomed the delegation from France led by Madam Anne Grillo, French Co-Chair of CEFIPRA and Monsieur Christian Testot, Minister Counsellor, Embassy of France in New Delhi. He mentioned that the Indo-French relationship in Science and Technology dating back to the early part of 20th century has matured over the years in the form of several initiatives. The Hon'ble Minister also highlighted the contribution of CEFIPRA to the Indian and French Science, Technology and Innovation System. He emphasized that CEFIPRA as a unique platform can play a pivotal role in fostering French cooperation under the various national missions launched by Hon'ble Prime Minister of India, Shri Narendra Modi ji with a great potential and a vast scope of French involvement through scientific and technological interventions in the campaign on Digital India, Make in India, Start-up India, Smart Cities, etc. He suggested that CEFIPRA should design and develop innovative programmes to foster new collaborations through academia-industry-government partnership models. The Hon'ble Minister expressed his optimism for greater opportunities and bigger successes for future Indo-French cooperation in continuation of the CEFIPRA's role to develop stronger ties in the field of Science, Technology and Innovation between India and France.

The Hon'ble Minister released the Annual Report for 2014-15 and Newsletter 'ENSEMBLE' (January-February, 2016) of CEFIPRA. After this ceremony, he took a tour at CEFIPRA office and interacted with officials. The poster display session was organized by CEFIPRA exhibiting some of the success stories of CEFIPRA supported research projects. Project collaborators of these projects briefed the Hon'ble Minister about their projects, which were appreciated by him. The Hon'ble Minister also recorded his remarks into the Visitors' Book of CEFIPRA, appreciating the contribution of CEFIPRA to promote joint scientific activities between India and France.

Some Glimpses



Hon'ble Minister at CEFIPRA Office along with French & Indian Co-Chairs



Hon'ble Minister meeting with the Monsieur Christian Testot, Minister Counsellor, Embassy of France in New Delhi and Madam Anne Grillo, French Co-Chair of CEFIPRA



Address by Hon'ble Minister



Release of CEFIPRA Newsletter 'ENSEMBLE' for January-February, 2016



Release of CEFIPRA Annual Report for 2014-15



2. Governance & Guidance

Guidance by the Governing Body

The 29th Governing Body (GB) meeting of CEFIPRA was organized on 4th March, 2016 at CEFIPRA office in New Delhi. It was Co-Chaired by Prof. Ashutosh Sharma, Secretary, Department of Science and Technology, Government of India and Mme. Anne Grillo, Director of Cultural Cooperation, Academic and Research, Directorate General of Globalization and Partnerships, Ministry of Foreign Affairs and International Development, Government of France. Several issues placed in the agenda were discussed and deliberated upon. The Governing Body took decisions and provided valuable guidance on CEFIPRA coordinated programmes and other policy matters.

The Centre, made possible for approximately 5500 scientists/researchers/students to come together under its Collaborative Scientific Research Programme. The GB members advised that the CEFIPRA should involve more in Public Private Partnerships. Many new initiatives have been started in India to bring forward number of energetic, intelligent and efficient young people through Start-up India, Digital India, etc.



The GB member opined that CEFIPRA should take the opportunity of Indo-French Joint Committee to have more impact on Science, Technology and Innovation partnership between the two countries. CEFIPRA has a special role to play by acting as a catalyser towards industrial partners and R&D clusters from both France and India. It should, therefore, disseminate information about its Industry Academia Research and Development Programme to Innovation Centres and clusters of the reputed organizations in India and also in France, as for instance to the competitive clusters. CEFIPRA can give wider publicity by targeting Incubators, Technology Clusters and Entrepreneurship Centres. It was also suggested to bring small industries, SMEs & Start-ups under IARDP.

The GB discoursed that the society is going towards translational research and suggested to explore creating a database of Indian and French industries, who will be willing to collaborate & to organize bilateral meetings in the name of “Partnership Development Programme” under Industry Academia Research and Development Programme (IARDP). The GB desired, CEFIPRA would be able to ascertain invention to innovation through its IARDP involving more entrepreneurs. The GB also suggested that the activities of the Centre can be presented from time to time to the R&D club meetings of the French Embassy in India. CEFIPRA must also think about mechanisms to encourage Indian companies to be partners with its programmes.

Meetings of the Scientific Council

The 55th & 56th Scientific Council (SC) meetings from 28-30 May, 2015 at Nice, France & 14-16 November, 2015, at Bangalore, India, respectively. The Council emphasized that the value of bottom-up collaboration has to be maintained and the areas supported by CEFIPRA should remain open and be maintained in ten domains of S & T.

The above two meetings the Scientific Council reviewed one hundred and eighteen new proposals in ten domains, out of which sixteen proposals were recommended for funding support. The proposals were recommended in the areas of Pure and Applied Mathematics(1), Computational Sciences(1), Life and Health Science(3), Pure and Applied Physics(5), Pure and Applied Chemistry(3), Materials Science(2) and Earth Sciences(1). During the financial year 2015-16, seventeen new projects were started.

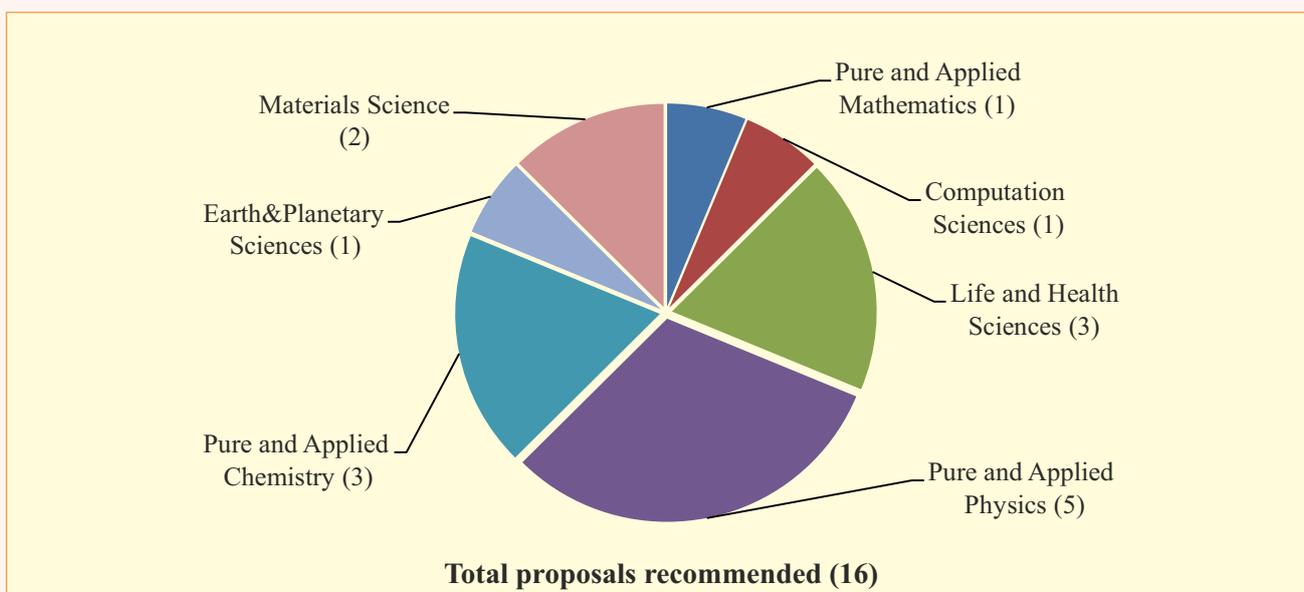
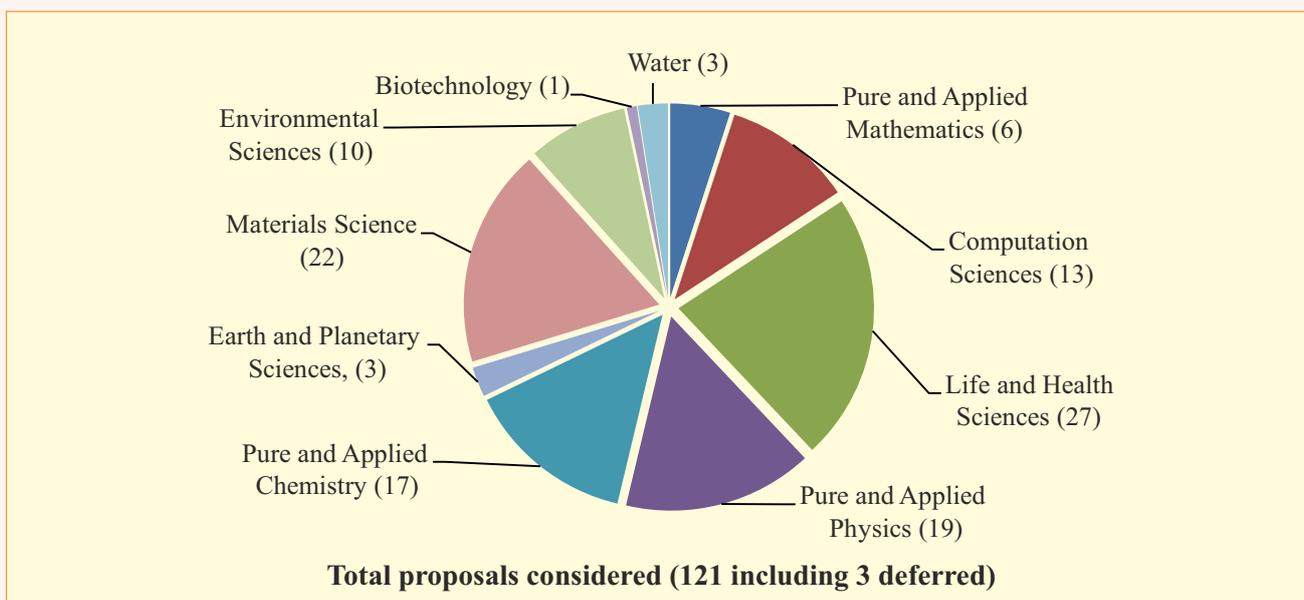
During the meetings, eighteen mid-term projects were reviewed in the following domains: Pure and Applied Mathematics(1), Computational Sciences(2), Life and Health Sciences(3), Materials Science (1), Pure and Applied Chemistry(6), Pure and Applied Physics(2), Environmental Sciences(1), Biotechnology(1) and Earth and Planetary Sciences(1). Final review was conducted in nineteen completed projects in following domains: Life and Health Sciences(3), Materials Science(4), Pure and Applied Chemistry(2), Pure and Applied Physics(7) and Pure and Applied Mathematics(3). The SC graded ten projects as 'Excellent' were in the areas of Life and Health Sciences (2), Pure and Applied Physics(4), Pure and Applied Chemistry(2) and Materials Science(2). 6 projects were graded as 'Very Good' in the areas of Pure and Applied Mathematics(3), Life and Health Sciences(1), Pure and Applied Physics(1) and Materials Science(1).



55th Meeting of the Scientific Council, 28-30 May, 2015,
Nice



56th Meeting of the Scientific Council, 14-16 November, 2015,
Bangalore



Thrust area wise distribution of proposals received/considered and recommended for support in 55th and 56th Scientific Council meetings.

The Scientific Council also suggested implementation of a pre-selection process to select the proposals for peer review for the system w.e.f. from 57th meeting of the Scientific Council to be held in May, 2016 in France.

The Scientific Council suggested, CEFIPRA to find ways for forward chaining of knowledge generated through CEFIPRA projects. Accordingly, Centre had assigned M/s Biotech Consortium India Limited (BCIL), New Delhi, the first phase of evaluation of R&D leads of fifty projects, which they had shortlisted after prima facie screening of projects supported by CEFIPRA. Subsequently, the Council discussed it in its 56th meeting and recommended that the report should be discussed along with the members of the Industrial Research Committee since the report gives some lead to the possibility of commercial potential. During the next meeting of the Scientific Council scheduled in France in May 2016, a joint overlapping meeting would be arranged with the meetings of Scientific Council and Industrial Research Committee to discuss the report.

Meetings of the Industrial Research Committee

The meetings of the 26th and 27th Industrial Research Committee (IRC) were held on 1st June, 2015 at Nice, France and 17th November, 2015 at Bangalore, India, respectively. During these meetings the Committee considered twenty concept proposals and recommended eleven, whereas out of four full proposals only two were recommended. Knowledge-Product pathway had been catalysed through six ongoing projects in the areas of Intelligent Transport System, Agriculture Science, Information Technology, Green Technology, Chemistry and Telecommunications under the Industrial Research Programme.

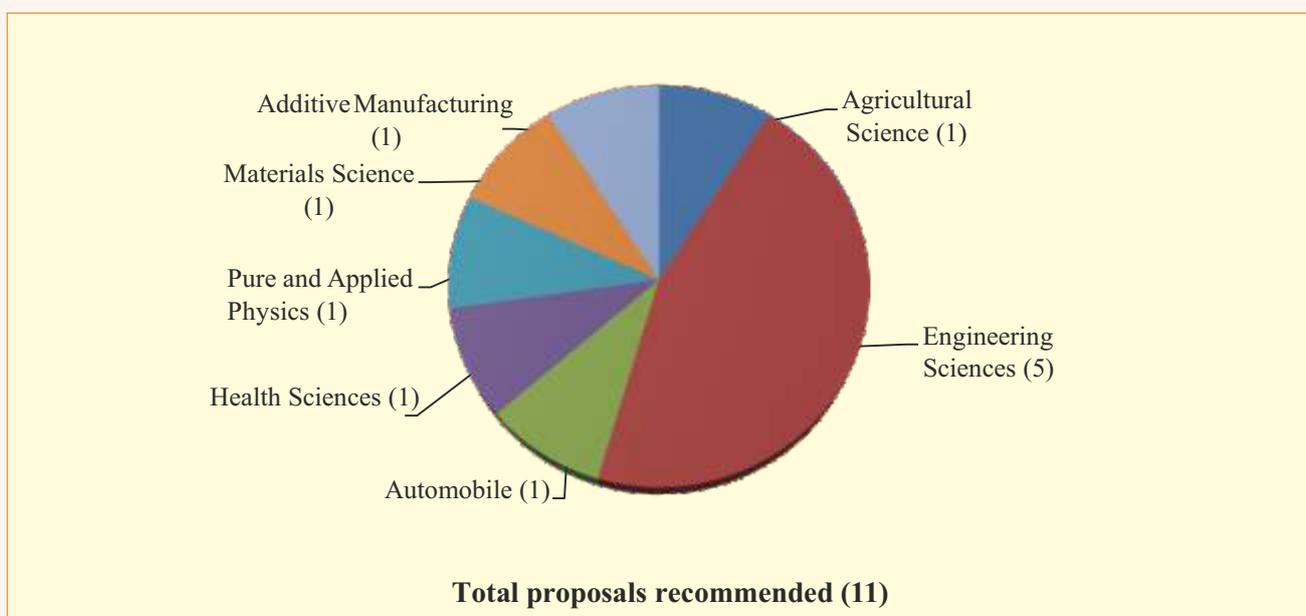
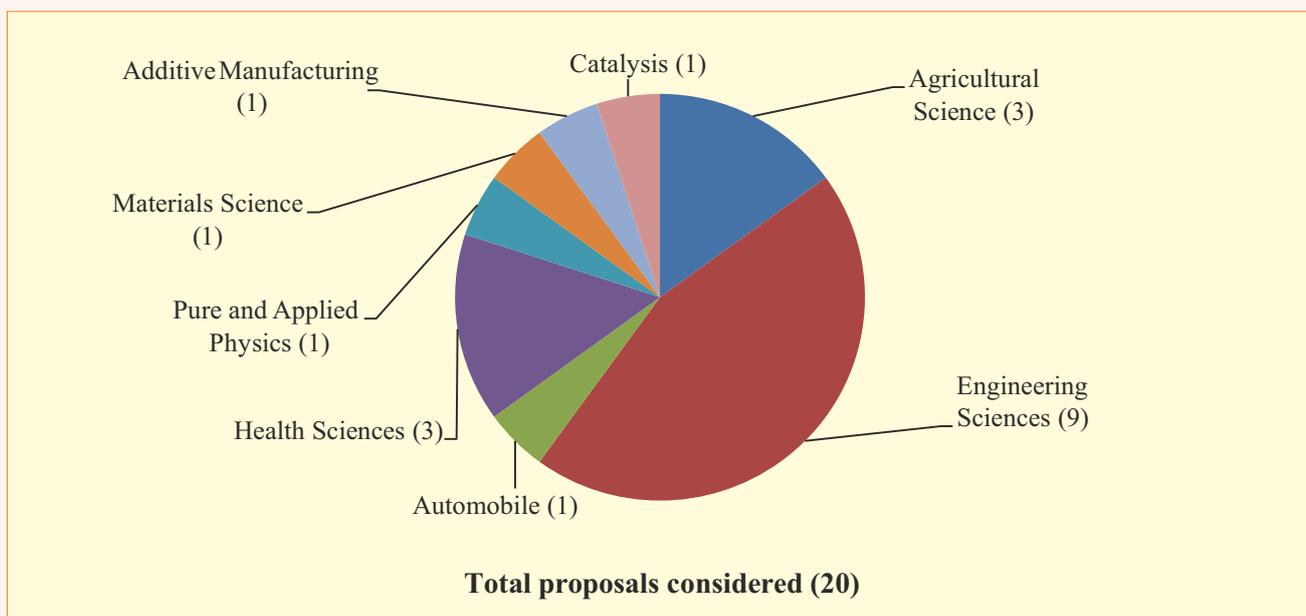


26th Meeting of the Industrial Research Committee,
1st June, 2015, Nice



27th Meeting of the Industrial Research Committee,
17th November, 2015, Bangalore

The Committee discussed the recommendations of 28th Governing Body meeting, which was held on 13th April, 2015 in Paris. The incubators of repute in Research and Development institutions were targeted for further improvement of Industry Academia Research & Development Programme. Further, the Committee noted that the aim and objectives for Industry-Academia Research & Development Programme are mentioned in the call for proposals. The expected deliverables were included in the future calls. Further, Committee noted that special calls are being announced on specific thematic area(s) of concurrent interest to both the countries, after prior discussion among all the Committee members.



Thrust area wise distribution of proposals received/considered and recommended for support in 26th and 27th Industrial Research Committee meetings



3. Seminars/Workshops & Outreach

CEFIPRA gives opportunity to the participants by disseminating information in public domain through different means with academic/research institutes and industries of both countries. In year 2015-16, CEFIPRA supported 11 seminars/workshops on contemporary topics of mutual interest to Indian and French S&T communities to enhance and promote new linkages & collaborations.

Digital Manufacturing and Prototyping		Hyderabad 13-15 April, 2015
Indian Institution/University	French Institution/University	
Mahindra École Centrale College of Engineering (MEC), Hyderabad	Centrale-Supelec , Metz	

The workshop had three primary themes: i) Materials and Manufacturing ii) Electronics, Communication and Optical technologies and iii) Simulation and Computer Science. Thirty-one number of scientists/ students/ researchers participated. Prof. Krishnamurthy, the workshop co-coordinator, highlighted the current scenario on manufacturing digital in India vis-à-vis in other major countries around the world. Founding Director of MEC, Prof Sanjay Dhande, addressed the participants focusing on the synergy between the digital world and manufacturing. He underscored the important role of sensors in digital manufacturing and the need to invest in research in this area. French Coordinator, Dr. Sebastien Ducruix of Centrale-Supelec addressed the participants on dwelling upon the mission of the French team. During first technical session, dedicated to the theme of ‘Materials and Manufacturing’, involved four presentations, one each from IITs in Delhi, Bombay and Hyderabad and one from Murugappa Group, Bangalore. The session evoked a productive discussion on the developments at a theoretical (IIT, Hyderabad) as well as experimental levels (IIT, Mumbai). Presence of the stakeholders from industry made it more relevant. Applications associated with the ceramic industry were discussed in detail and bringing out the opportunities in this space. As an outcome of this workshop one proposal was received under IARDP in optical technologies.



French-Indo Symposium on Correlated Oxide Materials (FISCOM)

 Montpellier
 15-17 July, 2015

Indian Institution/University	French Institution/University
Indian Institute of Technology (IIT) Madras, Chennai	Université de Montpellier, Montpellier

The objective of symposium in Materials Science was to address the current challenges at the frontiers of strongly-correlated oxide materials, particularly magnetic and structural properties and aimed at being the first step towards exploring potential collaborations in the areas of mutual interests. Thirty number of scientists/ students/ researchers participated. The symposium included oral presentations from various experts from different universities/laboratories/institutes of France and India. The research talks dealt mainly with topics like magnetism and magneto caloric effect in manganites, Berezinski-Kosterlitz-Thouless transition in ultrathin superconducting films, magnetic transition metal oxides: impact of the spins on the thermoelectric properties etc. Experimental and theoretical investigations were equally represented in the talks. The eight distinct groups from France were represented by sixteen French scientists while eight Indian groups were represented by fourteen Indian scientists. Opening remarks were given by Prof. Werner Paulus and Prof. M.S.R. Rao and was followed by talk of Emeritus Professor Michel Pouchard of ICMCB, Académie des Sciences, Bordeaux, France on the topic, “Fifty years of research in the solid state chemistry and materials science oxide domain”. At the end of symposium, there was a visit to various labs and facilities in the Université de Montpellier. The 2nd FISCOM edition was expected to be held in India in 2016 with the support from CEFIPRA.



**Frontiers in Cytoskeleton Research:
Coordination Adaptation Fine-tuning**

Pune
25-27 October, 2015

Indian Institution/University	French Institution/University
Indian Institute of Science Education and Research, Pune	Carsten JANKE - École des Neurosciences Paris Île de France

The seminar on “Frontiers in Cytoskeleton Research: Coordination, Adaptation, Fine-tuning” was organized by IISER Pune, with CEFIPRA support from 25-27 October, 2015 in Pune. The seminar was attended by twenty five scientists/researchers interested in understanding cytoskeletal processes. Each session was followed by intensive discussions on cytoskeletal dynamics across many scales. The ideas discussed were then taken further in theoretical models regarding acto-myosin dynamics. Students attending the seminar learnt about specialized cytoskeletal structures such as Cilia and Neurons, where four speakers explained how ciliary motion is required for flow of fluid in the brain and how traffic is controlled within Cilia and Neurons. The discussions then moved to cytoskeleton in mitosis, where new results were shown on kinetochore capture by micro-tubules and mechanisms of spindle aneuploidy. Eight students also gave short talks on their work. These discussions were continued through the poster sessions that were very well attended.

The current scenario in the cytoskeleton field and how collaborations could be sustained between the Indian and the French scientists in the future were also discussed to allow the French scientific community to appreciate on-site research community in India. As an outcome of the meeting, it was agreed unanimously that both countries would benefit significantly by discussing science in future meetings and by exchanging students. An address book including the contact details and talk titles of all speakers was sent to all speakers to facilitate future contacts.



Chemistry and Physics of Materials ScienceParis
26-27 October, 2015

Indian Institution/University	French Institution/University
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	Université Pierre et Marie Curie, Paris

A two day Indo-French workshop on “Chemistry and Physics of Materials Science” was held at Amphithéâtre Charpak, Université Pierre et Marie Curie, Paris from 26-27 October, 2015. Twenty four numbers of scientists/ students/ researchers participated in the workshop. The workshop objective was to establish and reinforce scientific and academic contacts between laboratories of the Sorbonne Universités and MATISSE Consortia in France and various Indian institutions in the field of Materials Science and moreover to encourage French students to avail of short-term exchange possibilities during their thesis or post-doctoral opportunities in Bangalore. On the aspect of future collaborations, it was decided to have a symposium in Bangalore in the autumn of year 2016 to allow the French scientific community to appreciate on-site research community in India. An address book including the contact details and talk titles of all speakers has been sent to all speakers to facilitate future contacts. It will also serve for the identification of areas of future collaboration like 2D materials, nanoparticle synthesis, fuel cells, synchrotron spectroscopy, novel ab-initio theoretical methods and high pressure research. On the aspect of student exchange, it was recommended to have an MoU to facilitate student exchange with Masters and Ph.D level exchange the preferred modes.



Bharat Ratna Prof. C.N.R. Rao during the Indo-French workshop on “Chemistry and Physics of Materials Science” held at Amphithéâtre Charpak, Université Pierre et Marie Curie, Paris from 26th -27th October, 2015

French-Indo Symposium on Correlated Oxide Materials (FISCOM)

New Delhi
29-31 October, 2015

Indian Institution/University	French Institution/University
Indian Institute of Technology (IIT) Madras, Chennai	Université de Montpellier, Montpellier

A workshop on "Understanding and Facilitation of Neural Plasticity for Enhancing Post Stroke Recovery" was organized during 29-31 October, 2015 in New Delhi. The coordinators were Dr. Anirban Dutta, INRIA, Université de Montpellier, CNRS, France and Dr. Padma Srivastava, Head of Unit II Neurology, AIIMS, New Delhi, India. Around twenty six Indo-French scientists and forty three students participated in this workshop. The workshop generated new ideas on non-invasive brain stimulations to facilitate cutting edge stem cell therapy as well as other combination therapies including Pharmacology; Relevance (and targeting with brain stimulations) of descending tracts other than cortico-spinal tracts for post-stroke motor recovery, relevance of the role of bilingualism in post-stroke language recovery which has a special significance in India, and, a brain network perspective to reorganization after stroke. Future areas of collaboration were identified as follows;

1. ANR-DST proposal on neuro-imaging guided subject-specific electrotherapy for stroke rehabilitation.
2. Technology transfer to India for clinical evaluation of the low-cost approaches for stroke neuro-rehabilitation developed in France (specifically, INRIA-DST ongoing project).
3. Continuation of discussions on non-invasive brain stimulation to facilitate cutting-edge stem cell therapy as well as other combination therapies for CEFIPRA.



Catalysis for Green and Sustainable ChemistryHyderabad
4-7, November, 2015

Indian Institution/University	French Institution/University
CSIR-Indian Institute of Chemical Technology, Hyderabad	Institut des Sciences Chimiques, University of Rennes-CNRS, Rennes

A 4-day Indo-French seminar on “Catalysis for Green and Sustainable Chemistry” was held in Hyderabad, India during 4-7 November, 2015 organized by CSIR-Indian Institute of Chemical Technology. Thirty eight scientists/students/researchers participated in the seminar.

The seminar primarily focused on recent advances in catalysis science and technology for sustainable development. Development of sustainable processes is increasingly perceived as one of the most feasible ways to mitigate global warming and diversify the energy sources. Catalyst enabled processes hold the key to several important technological solutions. Prof. S. Chandrasekaran, Honorary Professor, Indian Institute of Science (IISc), Bangalore presided over the function and emphasised the importance of the subject to be addressed at this seminar. Dr. B. M. Reddy, Chief Scientist & Head of Inorganic and Physical Chemistry CSIR-IICT and Indian seminar Coordinator addressed the gathering about the theme of the seminar. Thirty five lecture presentations on various topics within the scope of the seminar provided a most conducive platform for showcasing most recent progress made in understanding of fundamentals and significant breakthroughs of applied catalysis in niche areas. Prof. Pierre Dixneuf, the French Coordinator explained the genesis of the seminar and the participation of experts from Industry, R&D and Academic institutions on the chosen research topics to be deliberated at this seminar. The seminar was also dedicated to two most distinguished scientists from India and France, namely, Bharat Ratna Dr. A. P. J. Abdul Kalam and Nobel Laureate Prof. Yves Chauvin, who died very recently. Seminar provides a platform for showcasing the recent progress and breakthrough research in applied catalysis of niche areas.



**New Perspectives on Colour and Light:
Science, Arts and the Humanities**

Kolkata
12-13 November, 2015

Indian Institution/University	French Institution/University
Jadavpur University, Kolkata	Systems Lab. Centrale Supelec Grande voie des vignes, Châtenay-Malabry

Indo-French workshop on “New perspective on colour and light : science, arts and humanities” was organized from 12-13 November, 2015 at Jadavpur University, Kolkata, India. Seventy five scientists/ students/ researchers participated. The workshop was coordinated by Prof. Patrick Callet, of Applied Mathematics and Systems Lab. Centrale Supelec Grande voie des vignes, Châtenay-Malabry of France and Dr. Swati Bandyopadhyay, Head, Printing Engineering Department, Jadavpur University, Kolkata, India. The areas covered were from colour archiving in Museum, colour management in prints and textiles, colour emotions, packaging, colour psychology and emotion etc. Nineteen scientists from India and France and fifty five students participated in this workshop. Interactions on hifi or spot colours, colour psychology and emotion took place. 3 D printing was emphasized as a new idea. Workshop also helped in identified complementary collaborative partner Prof. Alain Treameau, University Jean Monnet, Dr. Swati Bandyopadhyay, Jadavpur University and Ess Dee Aluminium India regarding light fastness and water fastness of prints.

University Jean Monnet has offered Associate Academic Partnership for COSI programme and Jadavpur University has accepted it.



Futuristic Approach to Alternatives		Mumbai 17 November, 2015
Indian Institution/University	French Institution/University	
Indian Institute of Technology Bombay, Mumbai	L’Oréal Research & Innovation, Aulnay	

A one day seminar on “Futuristic Approach to Alternatives” was organized at the Indian Institute of Technology, Bombay (IITB) at Mumbai, India on 17th November, 2015. The seminar was sponsored by CEFIPRA and co-sponsored by L’Oreal India.

The objectives of the seminar included exploring alternatives to replace animal testing, bringing the attention of the research community towards the need for alternatives and to bring experts from different fields on the same platform and to identify lacunae. The meeting was attended by academicians from sixteen different institutes and representatives from fifteen different industries, regulatory bodies, industry associations and animal right activists. Experts from various fields including toxicology, pharmacology, lower order animal systems, tissue engineering, microfluidics and fabrication etc. participated. There were representatives from healthcare, beauty and chemical industries ranging from well-established MNCs as well as start-ups. Students from eight different institutes participated in the seminar. There were eight scientific talks spread over four sessions, one break-out session with five focused groups for goal specific discussions, students poster presentations and a focused panel discussion on initial screening to reduce the number of animals.

There are quite a few possibilities of formation of collaborations and projects. For example, there was discussion between L’Oreal and IITB, Marico and IITB, IITB and CCMB, IITB and ACTREC, ACHIRALAB and IITB, Achiralab and Snaayu Life Sciences, NIRRH and NII to name a few.



Application of Structural Biology in Translational Research & Structure Guided Drug- Design

Navi Mumbai
19-20 November, 2015

Indian Institution/University	French Institution/University
TMC-Advanced Centre for Treatment, Research and Education in Cancer, Kharghar, Navi Mumbai	AFMB – CNRS, UMR, Aix-Marseille Université

A two days Indo-French seminar, on “Application of Structural Biology in Translational Research & Structure Guided Drug-Design” was held at Tata Memorial Centre, Navi Mumbai during 19-20 November, 2015. Prof. Anil Kakodkar, Chairman, Technology Information, Forecasting and Assessment Council (TIFAC), New Delhi inaugurated the seminar. Prof. T.P. Singh from All India Institute of Medical Sciences, New Delhi, delivered the keynote lecture on therapeutic applications of proteins of innate immunity on the opening day. It was coordinated by Dr. Ashok K. Varma, Advanced Centre for Treatment, Research and Education in Cancer, Kharghar, Navi Mumbai, India and Dr. François Ferron, Laboratoire AFMB - CNRS - UMR, Aix-Marseille Université. The speakers enlightened the audience on the benefits of translational research; urging attendees to strengthen and generalize this approach in order to facilitate the transfer of knowledge from fundamental research to clinical research. Participants and research scholars very excited to know the role of structure biology in translational research and drug design. Panel members described the role of high throughput techniques in drug design.

The seminar was also open to local scientists, post-doctoral fellows and students, who actively contributed by presenting their research through poster presentations, interacted with the guest faculty. The seminar facilitated exchange of scientific thought between different groups from both countries. There were total 70 participants including senior professors, middle level and junior faculty/research scholars from 20 research centres and universities. Most of the talks were theme based, and all together the lectures were discussed on the latest discoveries in structural biology, rational drug design, high throughput methods and translational research in various fields of cancer research, bacterial infection, virology and neurodegenerative diseases. Scientific discussions focusing on the promotion international cooperation in the field of structure biology, bioinformatics and complementary methods were held. As an outcome of this seminar many projects would be generated from this first Indo-French seminar and are optimistic about the strengthening of bilateral cooperation in science and technology for structural biology, translational research and rational drug design against cancer and emerging diseases.



Smart System and SHM (Structural Health Monitoring) for Structures under Harsh Environment

Puducherry
20-22 January, 2016

Indian Institution/University	French Institution/University
Alliance Française de Puducherry, Puducherry	Airbus Safran Launcher, Les Mureaux

The Indo-French joint seminar on “Smart Systems and Structural Health Monitoring (SHM) for Structures under Harsh Environments” was organized from 20th - 22nd January, 2016 at Alliance Française de Puducherry, India.

The seminar focused on advanced research topics covered under the theme of SHM and highlighted the key role of this interaction in fostering research through industry and academic links between French and Indian participating institutions and individuals. Indian and French industrial organisations such as Airbus DS, Dassault Aviation, Reliance Ind., GE Jack Welch Research Centre, Bangalore and Indian & French Academia / Research labs and other agencies such as Commissariat à l’énergie atomique (CEA); Indira Gandhi Centre for Atomic Research (IGCAR); National Aerospace Laboratories (NAL); Council of Scientific & Industrial Research (CSIR) and Indian Institutes of Technology (IITs), Indian Institute of Science (IISc), Bordeaux University, Institut d’ Electronique, de Microélectronique et de Nanotechnologie (IEMN) Lille, French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR) on both sides had participated. There were thirty speakers from Indian and French industries and academia. A range of activities ongoing in the broad area of SHM were discussed. This included studies of wave phenomena in complex materials and media such as composites, concrete and heterogeneous metals, studies describing wave interaction with defective features in complex material joints such as composite bonds and their use for assessment of bond quality, advanced sensing techniques and modalities such as magnetostriction, fiber Bragg gratings (FBG), mobile computed X-ray tomography, higher order ultrasonic guided wave clusters and feature guided waves etc. The participants also gained a flavour of the geographical mapping of various research activities at institutions spread across India and France and their role in the SHM ecosystem. Work on SHM strategies for civil and industrial infrastructure in the process industries attracted much interest.

During workshop it was recommended for creation of a joint Indo-French Centre for Nondestructive Evaluation (NDE) education, training, certification and advanced collaborative research should also be explored as such a Centre can play a crucial role in interfacing and facilitating industry, research and academic interactions at various levels.



Nanoscaled Systems for Energy Harvesting

Chennai
1-3 Feb, 2016

Indian Institution/University	French Institution/University
Vellore Institute of Technology, Chennai	Ecole Nationale Supérieure d'Ingénieurs de Caen, Caen

A seminar on “Nanoscaled Systems for Energy Harvesting” was organized between 1-3 February, 2016 at Vellore Institute of Technology, Chennai campus. The aim of the seminar was to gather scientists from the field of the energy harvesting involved in the synthesis and studies of nanostructured systems to share and discuss the recent advances achieved in fabrication, doping, optical properties, plasmonics, light management and devices for energy applications such as photovoltaics, MEMS energy harvesters etc. A total of thirty four delegates including nine French scientists and twenty five Indian scientists as well as some students of the VIT University participated in this seminar.

The presentations during the three day seminar were focused on the recent development on photonics, photovoltaics, plasmonics, Li ion batteries and super-capacitors to address the global concern of energy harvesting using the advances in materials and technology. The last day included a tour of VIT Chennai research laboratories. There were two presentations on the facilities of VIT, Vellore and IIT Bombay to facilitate collaborations between the institutes. The discussions on the last day were dedicated to an exchange of ideas between researchers to allow the emergence of new collaborations and the development of new research projects. Some new ideas were evolved out of this seminar to further study the influence of environment and pollution in the efficiency of devices, effective utilization of bio-waste for energy generation etc. At the end of the seminar, three potential project proposals, in the areas of photovoltaic applications, plasmonics, water purification, were identified for submission to the CEFIPRA.



Outreach Programme in Nice, France

University of Nice
June, 2015



CEFIPRA conducted an outreach programme at University of Nice, France on 2nd June, 2015 with an aim to reach and create more awareness about different activities of CEFIPRA supporting Indo-French Science and Technology system. The programme was attended by representative from Department of Science and Technology, Government of India, several Principal Investigators of CEFIPRA supported project and researcher community. The first session on CEFIPRA's contribution in building different aspects of Indo-French S & T Cooperation was aimed to showcase results of CEFIPRA's intervention across Knowledge Innovation Value Chain. In this session, PI's and students shared their experiences with CEFIPRA in context of value of knowledge generation, improving industrial competitiveness and benefits of fellowships for conducting research in India or France.

Second session on Indo-French perspectives on STI collaboration through CEFIPRA was aimed to spread awareness about Indo-French collaboration in different fields and opportunities through CEFIPRA. This session was more interactive in the form of question and answer session about opportunities of Indo-French collaboration in various domains and through Industry-Academia interaction. Members of Scientific Council and Industry Research Committee took active part in this session. The session was finally concluded with success in reaching out potentially new stakeholders from the scientific research community in Nice.

Outreach Programme in Guwahati, India

Guwahati
July 2015



CEFIPRA has supported around 500 projects till date in different areas of basic and applied research. However, only 2% of those projects are from north-eastern states of India. Thus, during the Outreach Programme at Kolkata in 2014, it was decided to organise an outreach programme in the north-eastern regions of India. Accordingly, an outreach session was organized on 24th July, 2015 at Institute of Advanced Study in Science & Technology, Guwahati, Assam with an objective to reach out to the scientific communities in this region.

Approximately, 100 scientists, technologists, students participated from different parts of the North East Region. Prof. Arup Ratan Pal, Associate Professor, IASST gave some information about the foreign collaboration at North Eastern Region. He also informed some probable research topics shared by the Scientist for this region. Mr. R.S. Joshi, Chairman, Federation of Industry & Commerce of North Eastern Region (FINER) shared his experience about the promotion of Industries at North Eastern Region. Mr. Amitava Das, Education Advisor, Campus France Kolkata informed the audience about the opportunities available for higher studies at France. Mr. Tarun Keswani, Raman-Charpak Fellow 2014 shared his experiences emphasizing the unique benefits of this fellowship and its impact in his career.

Two panel discussions were organised. The first panel was on enabling mechanism of CEFIPRA's Industry Academia Research & Development Programme and its utility for the North-Eastern states of India. The Industrial Research Committee Members and other Scientists participated as panellists for this session. Dr. Pradip, member of Industrial Research Committee, CEFIPRA made a presentation highlighting about the scheme and mechanism of support for Industry Academia Research & Development Programme. Prof. Jayant Modak, Member of Industrial Research Committee, CEFIPRA gave overview about the mechanism for promotion of start-up. Other panellists invited from this region also gave their views about the innovation ecosystem and their expectation from CEFIPRA. There is a strong desire to have a bilateral seminar. After long discussion it was decided that a preparatory committee involving two faculties from IASST and Mr. Rajeev Aggarwal, Director, Federation of Industry and Commerce of North Eastern Region will be formed under the chairmanship of Prof. N.C. Talukdar, Director, IASST to identify the topic for the seminar and also to prepare some concept proposals under Industry Academia Research & Development Programme.

The second panel was on enabling mechanism of CEFIPRA's Scientific Collaborative Research Programme and its utility for the North-Eastern states of India highlighting about the scheme and mechanism of support for promotion of research. The Scientific Council member, panellists from the North Eastern Region and audience participated in panel discussion and gave their views. There is a strong desire to have a bilateral seminar and topic will be finalised by forming a committee under the chairmanship of Director, IASST.

Third session was on opportunities for students under Indo-French collaboration and its utility for the North-Eastern States of India. At the onset, Health Science, Mathematical Science, Biodiversity and Ecosystem in Traditional Knowledge, Herbal Medicine, Sericulture (Muga Silk), Fragrant Material were identified for collaboration for North Eastern Region.

CEFIPRA also participated in Open House Session on “India-EU funding opportunities” organized by INDIGO Policy on 17th December, 2015 in New Delhi. During the open house, participants had an opportunity to take part in several parallel discussions hosted by funding bodies/EU Science Councillors to learn more about Indo-EU funding schemes. French Embassy, CNRS, Bpifrance, BIRAC had also participated to learn more about various bilateral and other types of funding schemes.

Ensemble: The Newsletter of CEFIPRA

The CEFIPRA publishes a periodic bimonthly newsletter to communicate and highlight the research and development activities funded by the Centre, and dissemination of information to the user communities in India and France. Continuing with this tradition, CEFIPRA has published six issues during a year 2015-16 showcasing about the Centre's activities and programmes to patrons/policy makers, scientists, researchers and students. This is valuable tool which helps in increasing awareness about the India-France collaborative activities in R&D and innovation sectors.

The major topics highlighted in six issues were on Indo-French S & T Systems, Climate Change: A Global Challenge and Global Consensus on Climate Change, A Paris Agreement, Networking & Collaborating for Technology Developments; Reaffirming Common Commitment to S & T and Evolution beyond 25 years.

ENSEMBLE



 **CEFIPRA**
Bringing closer the
Indo-French S&T Systems

ENSEMBLE



 **Evolution of CEFIPRA**
The Body and the Soul

ENSEMBLE



 **Climate Change: A**
Global Challenge

ENSEMBLE



 **The Paris Agreement**
Global Consensus on
Climate Change

ENSEMBLE



 **India-France Relations**
Touching New Heights

ENSEMBLE

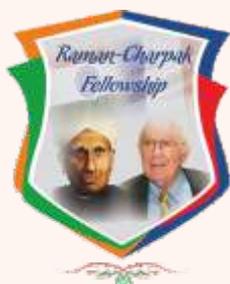


 **CEFIPRA:**
Joint Platform for Indo-French
Science, Technology and Innovation Partners



4. Dedicated Mobility Support Programmes

Raman-Charpak Fellowship



CEFIPRA implements the Raman–Charpak Fellowship Programme in honour of two Nobel Laureates in Physics, Prof C.V. Raman, Indian Nobel Laureate (1930) and Prof Georges Charpak, French Nobel Laureate (1992). The Raman-Charpak Fellowship is the only Indo-French bilateral Fellowship programme jointly funded by the Department of Science and Technology (DST), Government of India and the Service for Science and Technology (SST), French Embassy in India, Ministry of Foreign Affairs & International Development, Government of France.

The fellowship facilitates exchange of Doctoral (for India) and Doctoral/Masters (for France) students by providing them an opportunity to access to laboratories which are better equipped & suited for research work. Hence improving their overall research skills and carry out part of their research work in a University / Research Institute based in France or India, respectively. The scheme also provides an exposure and experience about the current research methods and trends in France and India, while discovering each another's cultural context.

During the year 2015-16, fifteen Indian and five French Doctoral students were supported. List is tabulated below:

S. No.	Name of the Fellow	Area	Name of Parent Supervisor and Institutional affiliation	Name of Host Supervisor and Institutional affiliation
1	 Mr. Santosh Kumar Singh	Physical Sciences	Dr. Sreekumar Kurungot CSIR- National Chemical Laboratory, Pune	Prof. Sabine Szunerits Institute de electronique, de Microelectronique et de Nanotechnologie, Lille University of Science and Technology, Villeneuve d'Ascq
2	 Mr. Amit Kumar Mondal	Chemical Sciences	Dr. Sanjit Konar Indian Institute of Science Education and Research, Bhopal	Dr. Hab Rodolphe Clérac Centre de Recherche Paul Pascal CRPP-CNRS UPR 8641, Pessac
3	 Ms. Sreekala S Nampoothiri	Life Sciences	Dr. Rajanikant G.K. National Institute of Technology, Calicut	Dr. Pierre Gressens UMR1141 INSERM - Université Paris Diderot, Département Hospitalo-Universitaire PROTECT, Hôpital Robert Debré, Paris

S. No.	Name of the Fellow	Area	Name of Parent Supervisor and Institutional affiliation	Name of Host Supervisor and Institutional affiliation
4	 Ms. Jincy Joy	Materials Science	Prof. Bhuvanesh Gupta Indian Institute of Technology - Delhi, Delhi	Dr. Didier Letourneur Inserm U1148 Laboratory for Vascular Translational Science X. Bichat Hospital-Inserm Building, Paris
5	 Mr. Anupam Bera	Chemical Sciences	Prof. Atanu Bhattacharya Indian Institute of Science, Bangalore	Dr. Franck Lepine Institut Lumiere Matiere, UMR5306 CNRS Université Claude Bernard Lyon 1, Lyon
6	 Ms. Nivedita Basu	Engineering Sciences	Prof. Navakanta Bhat Indian Institute of Science, Bangalore	Dr. Mathieu Lazerges Ecole Nationale Supérieur de Chimie de Paris, Paris
7	 Mr. Monjoy Saha	Engineering Sciences	Dr. Chandan Chakraborty Indian Institute of Technology - Kharagpur, Kharagpur	Dr. Daniel Racoceanu Sorbonne Universities, University Pierre and Marie Curie (UPMC) - Paris
8	 Mr. Ravi Raghavbhai Sonani	Life Sciences	Prof. Datta Madamwar Sardar Patel University, Anand	Prof. Bruno Robert Commissariat A L Energie Atomique (CEA), Saclay
9	 Mr. Rahul Panwar	Chemical Sciences	Dr. Ramendra Pratap Singh University of Delhi, Delhi	Prof. Schollhammer Philippe, UMR CNRS 6521-6 University of Western Brittany, Brest

S. No.	Name of the Fellow	Area	Name of Parent Supervisor and Institutional affiliation	Name of Host Supervisor and Institutional affiliation
10	 Mr. Sandip Banerjee	Mathematical and Computational Sciences	Prof. B. B. Bhattacharya Indian Statistical Institute Kolkata Dr. Arindam Biswas Indian Institute of Engineering Science and Technology, Shibpur	Prof. Jean-Danie Boissonnat, Inria Sophia-Antipolis Méditerranée - Sophia Antipolis
11	 Ms. Isha Taneja	Medical Sciences	Dr. Wahajuddin CSIR - Central Drug Research Institute , Lucknow	Dr. Alain Bousquet-Melou Toxalim UMR1331 INRA INP, Ecole Nationale Vétérinaire de Toulouse, Laboratoire de Physiologie, Toulouse
12	 Ms. Kakoli Bhattacharya	Physical Sciences	Dr. P. Deb Tezpur University, Tezpur	Dr. Véronique Dupuis Institut Lumière Matière, UMR5306 CNRS Université Claude Bernard Lyon, Villeurbanne
13	 Mr. Unmesh Govind Khati	Atmosphere and Earth Sciences	Prof. Gulab Singh Indian Institute of Technology - Bombay, Mumbai	Dr. Laurent Ferro- Famil University of Rennes 1, Rennes
14	 Ms. Devyani Samantarrai	Life Sciences	Dr. Bibekanand Mallick National Institute of Technology - Rourkela	Dr. Stéphan Vagner UMR 3348 CNRS, Institut Curie-Centre de Recherche, Université Paris Sud-11, Orsay
15	 Ms. Sruthi Sudhakaran	Materials Science	Dr. P V Mohanan Sree Chitra Tirunal Institute Medical Sciences and Technology, Thiruvananthapuram	Dr. Nadine Millot Laboratoire Interdisciplinaire, UMR 6303 CNRS/ Université de Bourgogne, Dijon

S. No.	Name of the Fellow	Area	Name of Parent Supervisor and Institutional affiliation	Name of Host Supervisor and Institutional affiliation
16	 Ms. Camille THEVENOT	Materials Science	Prof. Didier Rouxel Institut Jean Lamour - UMR 7198 CNRS - Université de Lorraine, Lorraine	Prof. Sabu Thomas International and Inter University Centre for Nanoscience and Nanotechnology, Mahatma Gandhi University, Kottayam
17	 Mr. Muhammad Khoirul Khakim Habibi	Engineering Sciences	Prof. Alexandre Dolgui École Nationale Supérieure des Mines de Saint-Étienne, Saint-Étienne	Prof. Manoj Kumar Tiwari Indian Institute of Technology Kharagpur, Kharagpur
18	 Mr. Sébastien Eskenazi	Mathematical and Computational Sciences	Prof. Jean-Marc Ogier Laboratoire L3i Pôle Sciences & Technologie, La Roche	Prof. Umapada Pal Indian Statistical Institute, Kolkata
19	 Mr. Daniel Thomert Balouek	Mathematical and Computational Sciences	Dr. Eddy Caron LIP Ecole Normale Supérieure de Lyon, Lyon	Dr. Arya K. Bhattacharya Mahindra École Centrale, Hyderabad
20	 Mr. Selim Bel Haj Salah	Materials Science	Prof. Laurent Pizzagalli UPR3346 CNRS/Université de Poitiers, Poitiers	Prof. Umesh V. Waghmare Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore

Debriefing Session for Raman-Charpak Fellows of 2014, on 12th January, 2016 at CEFIPRA office, New Delhi

In order to get feedback from the Raman-Charpak fellows and to improve upon the programme, a debriefing session for the Indian Raman-Charpak Fellows of 2014 was organized on Tuesday, 12th January, 2016 at the CEFIPRA office at New Delhi. The session was chaired by Dr. T. S. Rao, Former Scientist H and Senior Advisor at the Department of Biotechnology, Government of India. Welcoming the participants in the inaugural session, Dr. Mukesh Kumar, Director, CEFIPRA expressed gratitude towards the officials of International Cooperation (Bilateral) Division, Department of Science and Technology (DST), Government of India and French Embassy in India for their continuous support for the programme. Dr. Rajiv Kumar, Scientist E, Department of Science and Technology (DST), Government of India and Dr. Jenifer Clark, Attaché for Science and Technology, French Embassy in India, Bangalore highlighted the importance of the Raman-Charpak Fellowship which has brought Indo-French Science and Technology connections much closer. Prof. O. P. Sharma, former Professor, IIT Delhi and Dr. Ambuj Tripathi, IUAC, New Delhi attended the meeting as experts. Dr. T. S. Rao, Prof. O. P. Sharma and Dr. Ambuj Tripathi congratulated funding agencies and CEFIPRA for the successful completion of the Raman-Charpak Fellowship for past three years and praised the initiative for organizing a debriefing session with the students to understand the value and outcome of the programme. The 13 Indian fellows of 2014 participated in the debriefing session and provided feedback and experience of research work done by them under the fellowship in various host institutions & universities in France.

Geographical Linkages under Raman-Charpak Fellowship

The figure below shows a sample of geographical representation of applications received and host institutions in France and India for year 2015 call under Raman-Charpak Fellowship programme.

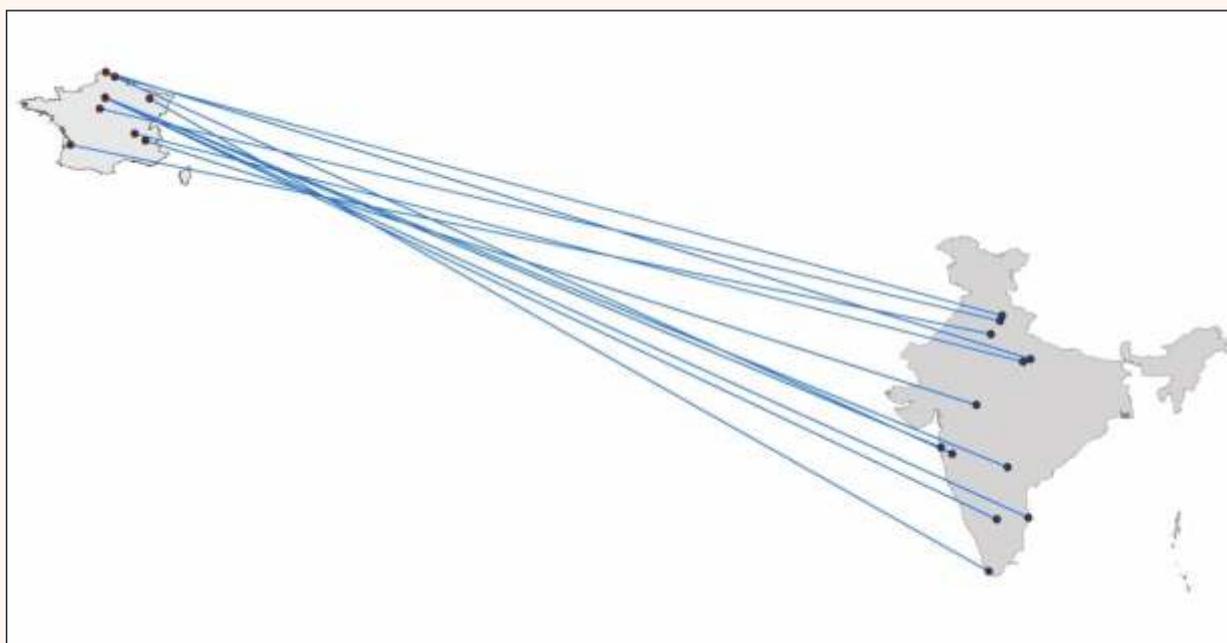


Figure : Geographical representation of applications received and host institutions in France and India for year 2015 call under Raman-Charpak Fellowship Programme.

CEFIPRA- European School on Nano-sciences and Nano-technologies (ESONN) Fellowship

CEFIPRA joined hands with Université Joseph Fourier (now Université Grenoble Alpes), Grenoble, France for supporting Indian doctoral students to participate in the ESONN session in Grenoble, France. ESONN is a three-week course aimed at providing training for graduate students, postdoctoral and junior scientists from universities and laboratories in the field of nano-sciences and nano-technologies in Physics, Biology and Chemistry.

During the year, sixty two applications were received and eight Indian doctoral students were supported for participation in the 12th edition of ESONN training programme held from 23th August to 12th September, 2015 at Grenoble, France.

The following Indian doctoral students were awarded the CEFIPRA-ESONN Fellowship of 2015-16.



Mr. Somesh Kumar
Indian Institute of Technology, Ropar



Mr. Shailendra K. Saxena
Indian Institute of Technology, Indore



Ms. Sweta Chander
Nation Institute of Technology, Silchar



Mr. Somesh Maity
Jadavpur University, Kolkata



Mr. Mayank Patel
Institute of Chemical Technology, Mumbai



Mr. Swarup Roy
University of Kalyani, Kolkata



Mr. Nirmal Kumar Das
Indian Institute of Science Education
and Research, Bhopal

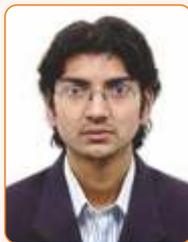


Ms. Anuja Das
Indian Institute of Technology, Kharagpur

CEFIPRA-SOLEIL Synchrotron

In an effort to utilize large scale scientific facilities available with India & France for the scientists/researchers of both the countries, CEFIPRA signed a MoU on 14th October, 2014 with SOLEIL Synchrotron to facilitate the use of the SOLEIL Synchrotron facility in France by Indian Scientists. During the year, CEFIPRA had supported the following proposals/ visitors under the Programme:

Call at SOLEIL:API5

S. No	Title of the Proposal	Name and Institutional affiliation of the Proposer
1	Detection of emission centres in highly luminescent complex nanomaterials by Extended X-Ray-induced-Photoluminescence Fine Structure (EXPFS) technique	Prof. Dipankar Das Sarma IISc, Bangalore
Name and Institutional affiliation of the Visitors Supported		
  		
Dr. Tirupathaiah Setti IISc, Bagalore Mr. Banabir Pal IISc, Bangalore Mr. Soham Mukherjee IISc, Bangalore		

Call at SOLEIL:API6

S. No	Title of the Proposal	Name and Institutional affiliation of the Proposer
1	Structural studies of Transcription regulators/ factors	Dr. Ramannathan Natesh IISER, Thiruvananthapuram
Name and Institutional affiliation of the Visitors Supported		
 		
Dr. Ramannathan Natesh IISER, Thiruvananthapuram Mr. Abyson Joseph IISER, Thiruvananthapuram		

S. No	Title of the Proposal	Name and Institutional affiliation of the Proposer
2	Depth resolved HAXPES study of YBa ₂ Cu ₃ O ₇ /SrRuO ₃ interface	Prof. Dipankar Das Sarma IISc, Bangalore
Name and Institutional affiliation of the Visitors Supported		
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Mr. Banabir Pal IISc, Bangalore</p> </div> <div style="text-align: center;">  <p>Mr. Shyamashis Das IISc, Bangalore</p> </div> <div style="text-align: center;">  <p>Ms. Sharada. G IISc, Bangalore</p> </div> </div>		
3	Interlayer exchange coupling with Antiferromagnetic spacer.	Dr. Krishna Kumar Menon Saha Institute of Nuclear Physics, Kolkata
Name and Institutional affiliation of the Visitors Supported		
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Dr. Krishna Kumar Menon Saha Institute of Nuclear Physics, Kolkata</p> </div> <div style="text-align: center;">  <p>Prof. Asish Kumar Kundu Saha Institute of Nuclear Physics, Kolkata</p> </div> <div style="text-align: center;">  <p>Prof. Suman Mandal IISc, Bangalore</p> </div> </div>		
4	<i>In-situ</i> study of water attachment in DMV-CS Langmuir Blodgett monolayer and cylindrical micelle on substrate and in Air Water interface	Prof. Milan.K.Sanyal Saha Institute of Nuclear Physics, Kolkata
Name and Institutional affiliation of the Visitors Supported		
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Prof. Milan. K. Sanyal Saha Institute of Nuclear Physics, Kolkata</p> </div> <div style="text-align: center;">  <p>Prof. G. C. Kulkarni Centre for Nano and Soft Matter Sciences(CeNS), Bangalore</p> </div> <div style="text-align: center;">  <p>Prof. Umesha Mogera JNCASR, Bangalore</p> </div> </div>		



5. Brief Reports of Research Projects

A. Collaborative Scientific Research Programme

Pure and Applied Mathematics

ANALYTIC ASPECTS OF MODULAR FORMS

Project No. 4601-2

Aug. 2012 to Jul. 2015

Background

The study area of the project is number theory, one of the major branches of pure mathematics. Modular forms have been the subject of intense research in analysis, arithmetic, geometry, topology etc. The project objective was to focus on the analytic aspect of these developments. Research interests are related to questions and central themes of number theory such as the Langlands program, the generalized Riemann hypothesis and the Birch and Swinnerton-Dyer conjecture.

Objectives

- To study the analytic aspects of the theory of modular forms in particular the L-function of modular forms

Knowledge Generated / Products Developed

- Quantitative results on the sign changes of the coefficient of the spinor zeta function
- Another result concerns the Hecke eigenvalues of a Siegel cusp form of genus two Investigators showed that a positive proportion of the Hecke eigenvalues are non-zero. Among the non-zero Hecke eigen values they showed that asymptotically half are positive and half are negative

Principal Collaborators



J. Sengupta
Tata Institute of Fundamental Research
Mumbai



J. Wu
Institut Elie Cartan
Université de Nancy
Nancy

Publications

- No. of publications in SCI journals : 2
- No. of papers presented in conferences: Nil

Mobility Support

- India to France:6
- France to India:7



Pure and Applied Mathematics

DISCONTINUOUS GALERKIN METHOD FOR NONLINEAR ACOUSTICS

Project No. 4601-1

Dec. 2011 to Aug. 2015

Background

Weak shock waves are one of the most spectacular features of nonlinearities in acoustics. Since shock waves are characterized by sudden pressure variations, the frequency spectrum turns out to be especially broadband, with low as well as high frequencies. Various frequencies of the spectrum are strongly coupled to one another through nonlinear interactions and hence cannot be computed independently. Also, nonlinear shock waves generally propagate over very large distances relative to the main wavelength.

Objectives

The project proposal aimed at developing a local discontinuous Galerkin method for the advanced numerical simulation of nonlinear shock waves in 2D complex geometries with applications to acoustical problems

Knowledge Generated / Products Developed

- Development of a new shock sensor for unstructured mesh sensitive to acoustic shock waves
- Formulation of a new element centered smooth artificial viscosity for the equations of nonlinear acoustic
- Introduction of an original notion of gradient factor to compute the amount of viscosity

The numerical solver has been validated by comparisons between numerical results and standard configurations. Then, it has been used to investigate two different physical situations. The first one is the nonlinear reflection of acoustic shock waves on rigid surfaces. Different profiles have been investigated: wedges with different angles and convex-concave profiles. Different regimes of reflection have been observed ranging from the classic Snell Descartes reflection to the weak von Neumann one. The reflection of the secondary Mach stem has been observed numerically for the first time. The second configuration deals with the focusing of shock waves produced by high intensity transducers (like those used in HIFU therapy). Special attention has been paid to the careful computation of intensity and to the interaction between the shock waves and obstacles in the region of the focus. It is informed it is noticeable that these simulations were not possible before the project but are possible now.

Principal Collaborators



Sambandam Baskar
Indian Institute of Technology Bombay
Mumbai



Régis Marchiano
Université Pierre et Marie Curie
Paris

Publications

- No. of publications in SCI journals: Nil
- No. of papers presented in conferences: 4

Mobility Support

- India to France: 2
- France to India: 2

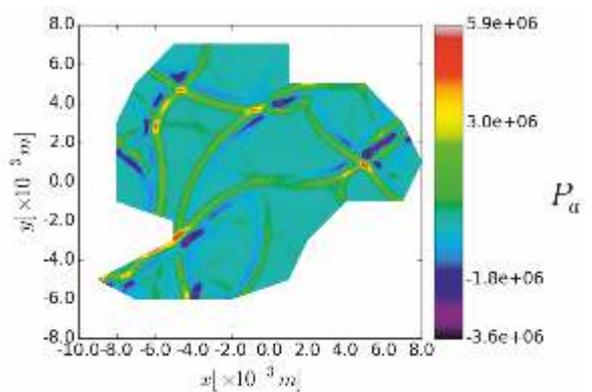


Illustration of the reflection of a cylindrical acoustic shock wave on the rigid boundaries of a complex domain

Computational Sciences

MULTILINGUAL WORD SPOTTING FOR DEGRADED DOCUMENTS

Project No. 4700-IT-1

May 2012 to Feb. 2016

Background

In India and France there are huge scanned documents some of which are historical (in image format). Some of these documents are with noisy background and broken foreground. For retrieval of relevant documents from this huge database and for their categorization, word-spotting technique is very useful. In this context, the objective of the project was to develop multi-lingual and multi-script word spotting methods (in this project considered main Indian languages like Bangla, Devnagari and Telugu, along with English and French languages for the benefit of the two collaborative countries). Indeed, word spotting received an increasing interest during the past few years since it represents an interesting alternative to OCR (Optical Character Recognition)/ICR (Intelligent Character Recognition) for document indexation and retrieval especially in the case of specific documents (highly degraded, historical, fax, letters and handwritten documents). Even if some pieces of work have been done, it remains a challenging issue, especially considering multi-lingual aspect, robustness to partial degradations of words etc. Also user feedback based fine-tuning was also used. The project mainly dedicated to printed modern and historical documents but extension to handwritten documents was also considered.

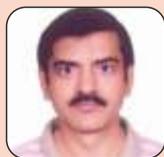
Objectives

- To be able to deal with old and degraded documents, especially when images of candidates words are not exactly similar to query (retrieval of candidates that match partially)
- To be able to search inside graphical parts with multi-oriented text (maps for example)
- To elaborate methods that are independent from language of the document
- To be able to integrate user feedback to improve the ranking of the retrieval

Knowledge Generated / Products Developed

- A word-spotting software prototype was developed. The GUI (Graphical User Interface) allows integrating several word-spotting engines such as those developed inside the project, but also others. It allows navigating and searching inside images of text documents
- A toolbox in C++ with classical sequence matching algorithms (Dynamic time warping) was developed, including two new algorithms:
 - o Flexible Sequence Matching (FSM) can operate partial matching inside target by skipping noisy elements (begin, end, and inside target). Many-to-one matching is also allowed to take into account local stretching
 - o ESC (Elastic Sequence Cardinality) is an extension of FSM. In addition, it can skip elements in query signal also
- A two-stage approach for word spotting in graphical documents has been elaborated (for Latin and Indian scripts)

Principal Collaborators



Umapada Pal
Indian Statistical Institute
Kolkata



Nicolas Ragot
Université François Rabelais Tours
Tours



A query word found inside a line

Publications

- No. of publications in SCI journals : 1
- No. of papers presented in conferences: 8

Mobility Support

- India to France: 5
- France to India: 4

COLLECTIVE MIGRATION IN THE FLY NERVOUS SYSTEM

Project No. 4403-1

Apr. 2012 to Mar. 2016

Background

Collective behaviours and cell interactions are major features in the development of multicellular organisms and defects in these processes trigger severe human pathologies including cancer. Due to the complex nature of collective processes, it is important to use simple genetic models that allow for *in vivo* analyses. The PIs explored the cellular and the molecular mechanisms underlying collective behaviours occurring during *Drosophila neurogenesis* and analysed their impact in a variety of assays, from time-lapse analyses to behavioural output. The work was demonstrated the importance of highly coordinated and timely interactions for the building of a tissue as complex as the nervous system. In addition, discovered novel molecular mechanisms at work in collective migration.

Objectives

To analyse the molecular mechanisms underlying cell migration, a key process in development and in metastatic events. The identification of novel molecular cascades and signalling molecules controlling migration may lead to better therapeutical targets in cancer.

Knowledge Generated / Products Developed

Adhesion molecule N-cadherin is an important determinant of tumor progression that acts as a molecular brake during collective migration

- The unconventional N-cadherin cascade involved in collective migration
- Connecting intrinsic and extrinsic cues controlling collective cell migration
- The glial determinant controls the expression of the Netrin chemoattractant receptor frazzled
- The Netrin pathway and glial migration

Principal Collaborators



K. VijayRaghavan
National Center for Biological Sciences
TIFR
Bangalore



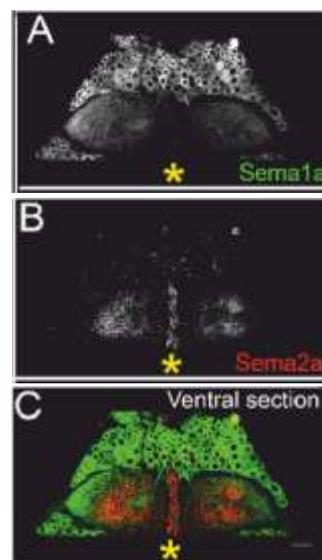
Angela Giangrande
Institut de Génétique et de Biologie
Moléculaire et Cellulaire
CNRS
Strasbourg

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 1
- France to India: 3



Sema2a is highly expressed in the ganglionic midline and intermediate region. Immunocytochemical analysis of expressions of Semal1a and Semal2a in prothoracic ganglion at 25h APH, A-C- Ventral Section

Life and Health Sciences

STUDYING THE INTERACTOME OF NAD-DEPENDENT DEACETYLASE SIRT I IN THE MOUSE TESTIS

Project No. 4503-1

Sep. 2011 to Aug. 2015

Background

Sirtuins are NAD-dependent proteins that link metabolic inputs to cellular and organismal physiology. In mammals there are 7 sirtuins of which three are localized to the nucleus (Sirt1, Sirt6, Sirt7), three to the mitochondria (Sirt3, Sirt4, Sirt5) and one in the cytoplasm (Sirt2). Due to their ubiquitous expression and dependence on NAD they have been implicated to play a critical role in affecting normal and pathophysiology including age-related diseases such as cancer, obesity and diabetes. Despite several reports that have highlighted their cellular functions, upstream signals that mediate post translational modifications (PTMs) and interacting partners are largely unclear for several sirtuins. This project aimed to uncover the molecular mechanisms of sirtuin functions by investigating modifications of Sirtuins and their interacting partners. (full length and short isoforms of Sirt1 and the evolutionarily conserved mitochondrial sirtuin Sirt4). Unless upstream and downstream modulators of sirtuins are studied, efforts at delineating their key roles in aging mechanisms will remain unknown.

Objectives

- Identification of the interactome of Sirt1
- Differential interactions of the Sirt1 splice variants
- Functional validation of the identified interactome
- Identification of proteins that interact with Sirt4
- Identification of Sirt1 dependent Acetyl Proteome

Knowledge Generated / Products Developed

- Identified novel isoform of Sirt1 based on MS/MS analyses
- Performed high throughput analyses and identified novel Sirt1 interacting proteins (both full length and delta-E2 isoforms) from cells in culture and from tissues
- Identified novel interacting proteins of Sirt4
- Standardised and established methodologies to analyse acetyl-proteome of cells and tissues
- Unravalled the role of acetylation in regulating CDK1 functions in cell cycle progression
- Standardisation of methodologies to analyse acetyl-proteome
- Standardising of tools to study other acyl-modifications of proteins

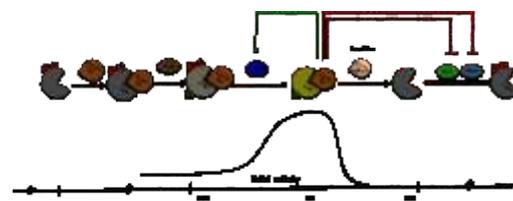
Principal Collaborators



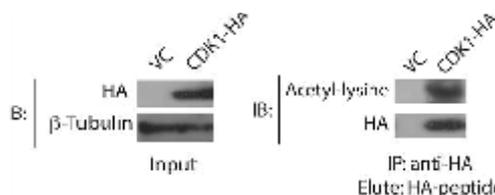
Ullas Kolthur Seetharam
Tata Institute of Fundamental Research
Mumbai



A. Gonzalez de Peredo
Institut de Pharmacologie et de Biologie
Structurale (IPBS)
CNRS Toulouse



Cell Cycle progression and known regulatory events in CDK1 activation



Western blot shows acetylation of CDK1 in cells

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 1

GENOME-WIDE RECRUITMENT PROFILE OF BLM AFTER DNA DAMAGE

Project No. 4603-1

Nov. 2011 to Oct. 2015

Background

Mutation in the BLM helicase results in Bloom Syndrome (BS), an autosomal recessive disorder. Patients with BS exhibit hyper-recombination and are prone to almost all forms of cancer. Although previous work from the research groups of the collaborators and others, have clearly implicated the BLM protein in the DNA Double Strand Breaks (DSB) response and repair, its exact role in these pathways still remains to be fully deciphered. The developed new system is capable of generating sequence-specific and annotated DSBs across the genome. This technology can be used to profile DSB repair proteins around multiples breaks at high resolution, when coupled to high throughput technologies like ChIP-chip and ChIP-seq. Using this system, the proposal was to generate the first comprehensive recruitment map of BLM on the human genome, before and after DSB induction. This supposed to be a major step towards characterizing of how BLM accumulates at DSB sites, and reveals the factors that contribute to its recruitment.

Objectives

- ChIP-chip profiling of BLM at DSBs generated by AsiSI-ER, in asynchronous cells
- Profiling of BLM at DSBs generated by AsiSI-ER, in synchronized cells
- Investigate the determinants that control BLM accumulation at DSBs

Knowledge Generated / Products Developed

- Demonstrated that BLM and H2AX are present at the double strand breaks (DSBs) upon DNA damage induction in U2OS-AsiSI-ER cells Provided evidence that BLM and H2AX are present in a chromatin bound complex at the sites of double stand breaks
- Successfully carried out the genome-wide recruitment of BLM following DNA damage Carried out validation of BLM recruitment at DSBs. Determined the effect of BLM depletion on resection
- Carried out the cell synchronization studies to determine the recruitment of BLM at the DSBs at different phases of the cell cycle
- Demonstrated the recruitment of BLM in S and G1 phase of the cell cycle Shown how BLM interacts with different repair machineries in S and G1 phase of the cell cycle. Provided evidence that the recruitment of BLM to the site of damage depends not on ATM but on MRN complex
- Mechanistically shown that the interaction between BLM and MRN complex regulates its recruitment to the DSBs

Principal Collaborators



Sagar Sengupta
National Institute of Immunology
New Delhi



Gaëlle Legube
Cellulaire du Contrôle de la
Prolifération, CNRS UMR 5088
Toulouse



Recruitment of BLM and pSer139 H2AX (γ H2AX) at the sites of double strand breaks (DSBs). Chromatin immunoprecipitations (ChIPs) were carried out on AsiSI-ER cells treated with OHT for 6 hr. Recruitment at the sites of DSBs were determined by carrying out Western analysis with antibodies against BLM and gH2AX or the corresponding IgG. The immunoprecipitates were probed with BLM and pSer139 H2AX antibodies

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 1
- France to India: 3

Life and Health Sciences

ANTI-FACTOR H AUTOANTIBODY ASSOCIATED HEMOLYTIC UREMIC SYNDROME

Project No. 4703-1

Sep. 2012 to Jan. 2016

Background

Hemolytic Uremic Syndrome (HUS), characterized by acute kidney injury, micro-angiopathic haemolytic anemia and thrombocytopenia, is the most common cause for acute dialysis in children. Presence of auto-antibodies to complement factor H (CFH) is an important cause of atypical HUS across the world, especially in south Asia. While >85% patients with anti-CFH associated-HUS show a polymorphism, it is speculated that environmental or genetic factors might be necessary for the disease to manifest. Preliminary results from Europe show an association of aHUS with HLA-A24, but there is lack of such information in Indian patients. Similarly there is no data on the frequency of mutations in other genes, including CFI, CFB, C3, CD46, DGKE and thrombomodulin in patients with antibody-negative aHUS.

Objectives

- Validate anti-factor H antibody assay in India and establish a normal threshold
- Obtain genetic insights into the mechanisms of immunization against factor H by: (i) determining MHC haplotype; (ii) examine deficiency of CFHR1 in patients, relatives and controls
- Screen for mutations in genes implicated in susceptibility to HUS
- Study anti-factor H cellular immune response, through constitution of a peripheral blood mononuclear cell and plasma samples bank of patients with HUS and anti-FH IgG antibodies
- Determine microbial triggers associated with the disease, by: (i) collection of clinical and biological data, (ii) parasitological and bacterial exam of the stools, and screening for fecal shigatoxin, (iii) serological identity of infections

Knowledge Generated / Products Developed

- Validation & clinical application of anti CFH assay
- Set up and validated quantitative and end point PCRs as an alternative to MLPA for diagnosing the deletion
- MHC Data. Increased frequency of the HLA A24 allele and a lower frequency of the HLA A11 allele observed in patients' group as compared to the Control group
- Mutations in genes implicated in aHUS. Mutations in MCP and surface expression of the protein (CD46). Sequencing of MCP
- Evaluation for shiga toxin (Stx)
- Microbial triggers
- Anti-factor H cellular immune response

Principal Collaborators



Arvind Bagga
All India Institute of Medical Sciences
New Delhi



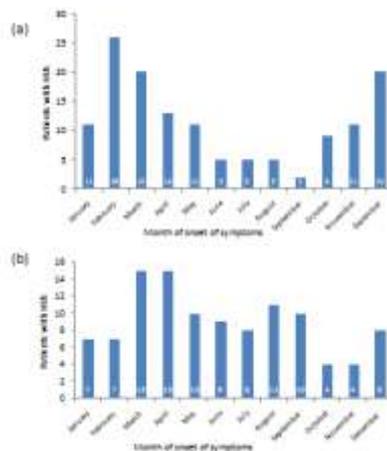
Marie-Agnès Dragon-Durey
INSERM UMRS 82, Cordeliers
Research Center
Paris

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: 4

Mobility Support

- India to France: 3
- France to India: 2



Frequency of patients with onset of (a) anti-complement factor H antibody associated HUS and (b) autoantibody negative HUS in relation to month of the year

Life and Health Sciences

MECHANISMS OF LYSINE ACETYLTRANSFERASE (KAT/HAT) ACTIVATION BY SMALL MOLECULE ACTIVATORS AND USE THEREOF IN MEMORY

Project No. 4803-3

Jan. 2013 to Dec. 2015

Background

Convincing evidences suggest that chromatin modifying machineries have a role in CNS disorders. The CREB-Binding Protein (CBP) is an acetyltransferase which plays a crucial role in neuronal survival, as well as in memory formation. Previous work has shown that CBP function is altered in neurodegenerative diseases. As it becomes clear that chromatin is dynamic and is subjected to extensive experience and age associated remodelling, it was quickly realized that a pharmacological tool, able to modulate histone acetylation could represent a good therapeutic option. So far inhibitors of histone deacetylase (HDAC) enzymes have been used, thanks to their great development in cancer research. However, a therapeutic strategy based on HAT activation, and specifically that of CBP, could prove efficient to treat memory disorders found in neurodegenerative diseases. Accordingly, the PIs proposed to characterize a newly-generated HAT activator and study its effects on brain functions (e.g. adult neurogenesis, memory formation) in normal and in Alzheimer's disease mouse models.

Objectives

- Development of HAT activators and its evaluation in a cell line
- Distribution of a recently produced permeant nanoparticle conjugated KAT activator (CSP-TTK21) within the organism (mice) following intraperitoneal injection
- Evaluate the potential neurogenic effect of CSP-TTK21 HAT activator in the hippocampus and underlying molecular mechanisms.
- Characterize CSP-TTK21 effect on memory formation (recent and remote spatial memory) in wild type adult mice
- Test CSP-TTK21 as a new therapeutic option in a transgenic Alzheimer's disease mouse model
- Shape directed compartmentalized delivery of a nanoparticle-conjugated small molecule activator of an epigenetic enzyme

Knowledge Generated / Products Developed

First time that *in vivo* pharmacological activation of the HATs CBP/p300 is achieved in the adult mouse, with the conjugation of an activator molecule (TTK21) to a carbon nanosphere (CSP) particle. Pre-clinical studies with CSP-TTK21 HAT activator led in normal and pathological (Alzheimer's model) mice showed a benefic effect on plasticity and memory-related processes, with a clear mode of action defined at the epigenomic and genomic levels. Such molecules or derivatives could be of use for bringing cognitive recovery in neurodegenerative diseases. Further improvement in the drug delivery by producing shape-directed nanoparticles able to specify subcellular compartment, will help to carry molecules targeting epigenetic enzyme closer to the gene sites

Principal Collaborators



Tapas Kumar Kundu
Jawaharlal Nehru Centre for
Advanced Scientific Research
Bangalore



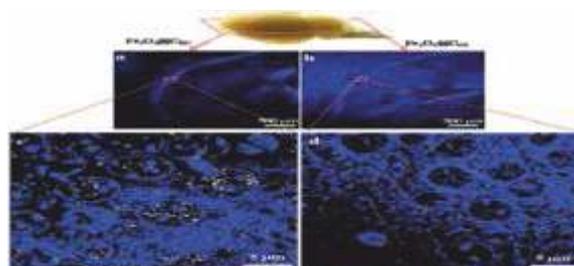
Anne-Laurence Boutilier
Laboratoire d'Imagerie et de
Neurosciences Cognitives, CNRS UMR 7237
Strasbourg

Publications

- No. of publications in SCI journals : 7
- No. of papers presented in conferences: 3
- No. of patents: 2

Mobility Support

- India to France: 2
- France to India: 2



Differential entry of nanoparticles into the brain cell nucleus. After 72 hours (3 days) of intra-peritoneal injection of Fe₃O₄@CBC (a and c) and Fe₃O₄@CNT (b and d) in BALB/c mice, brains were processed for confocal microscopy. Blue colour represents nuclear staining with Hoechst. Yellow shows the nanoparticle fluorescence

Life and Health Sciences

TRANSCRIPTOMICS AND METABOLOMICS IN PATIENTS WITH STEROID NON-RESPONSIVE SEVERE ALCOHOLIC HEPATITIS

Project No. 4903-3

Apr. 2013 to Mar. 2016

Background

In India and France, patients with severe alcoholic hepatitis are treated with corticosteroids. However, only 40% of patients respond to corticosteroids and non-responders are at high risk of short-term death. To date, there is no established alternative or additive treatment to corticosteroids. Moreover, there are no identified predictors of the response to corticosteroid therapy.

Objectives

- The first aim was to identify baseline molecular mechanisms that predict the subsequent response or non-response to corticosteroids. For this, gene/exon-expression profiling in the liver and peripheral blood mononuclear cells (PBMCs) as well as metabolomic profiling of liver, plasma and urine will be performed at baseline (i.e., day 0, before starting corticosteroids)
- To identify molecular mechanisms associated with the response to corticosteroid therapy. For this, gene/exon-expression profiling in PBMCs and metabolomics profiling of plasma and urine to be performed at day 4 and day 7 of corticosteroid therapy. Results to be compared between responders and non-responders to treatment

Knowledge Generated / Products Developed

- Standardization of High resolution mass spectrometry based method for metabolite identification in urine and plasma samples
- Characterization of urine and plasma proteomes in different groups of patients
- Standardization of Next Generation Sequencing based identification of MicroRNA present in the PBMCs
- Standardization of Next Generation Sequencing based identification of differentially regulated genes in the transcriptome of Liver tissue and PBMCs

Principal Collaborators



Shiv Kumar Sarin
Institute of Liver and Biliary Sciences
New Delhi



Richard Moreau
Centre de Recherches sur l'Inflammation
Inserm U773
Paris

Publications

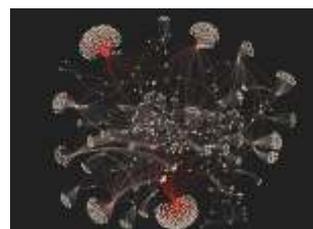
- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France:1
- France to India:Nil



Protein-protein interaction network of upregulated gene set. UBD and ITGA4 were identified as the genes with most interactions in the network



Protein-protein interaction network of downregulated gene set. ALB and FOS were the main proteins identified for protein-protein interaction

Life and Health Sciences

NOVEL NANOTECHNOLOGICAL APPROACHES FOR THE TREATMENT OF LEISHMANIASIS USING 2-PROPYLQUINOLINE

Project No. 4803-4

Jan. 2013 to Dec. 2015

Background

Visceral leishmaniasis is a parasitic disease affecting both India and France, caused by a protozoan parasite that is fatal if left untreated. Chemotherapy is the only way to treat this disease with few drugs available, such as antimonials, miltefosine, and the liposomal formulation of amphotericin B that are expensive, toxic and generating drug resistance. As a consequence, there is a need to develop new drug candidates. 2-Propylquinoline, is a natural compound isolated from a Bolivian tree traditionally used to treat leishmaniasis by the traditional practitioners. This compound is a promising candidate, since it was screened for *in-vivo* antileishmanial activity by oral route, exhibiting similar activity as miltefosine. But there are some drawbacks of using 2-PQ such as, a very short *in-vivo* half life (about 1 hour) and its lipophilic nature making it difficult to prepare an intravenous formulation. This program was focused on drug delivery strategies for optimizing the compound biodistribution.

Objectives

The project aimed to design novel nanoformulations of 2-propylquinoline (2-PQ), an emerging drug with potential for the treatment of leishmaniasis in humans. Specifically, the aim of this project was to prepare, characterize and test for efficacy *in-vitro* and *in-vivo*:

- a liposomal formulation of 2-PQ able to concentrate the drug in the liver and spleen for treatment of *visceral leishmaniasis*
- water-soluble polymer conjugates with 2-PQ able to prolong the half-life of the drug in the blood circulation
- long-circulating nanoformulations for disseminated leishmaniasis able to carry the drug throughout the body
- a liposomal formulation containing both 2-PQ and AmB to combine the advantages of the two drugs for visceral leishmaniasis and help prevent the development of resistance

Knowledge Generated / Products Developed

- The most significant findings are the production of two liposomal formulations, one containing only 2-propylquinoline and the other one containing a combination of 2-propylquinoline and amphotericin B
- 2-n-propylquinoline (2-n-PQ) had shown interesting *in vivo* anti-leishmanial activities after administration by oral route on leishmaniasis animal models.
- Two strategies were developed, one focused on soluble drug-polymer conjugates and the other one dedicated to particles systems.
- A liposomal formulation of 2-n-propylquinoline, dedicated to the treatment of *visceral leishmaniasis* has successfully been prepared and, some quinolones derivatives have been synthesized for *in vitro* and *in vivo* anti-leishmanial evaluation

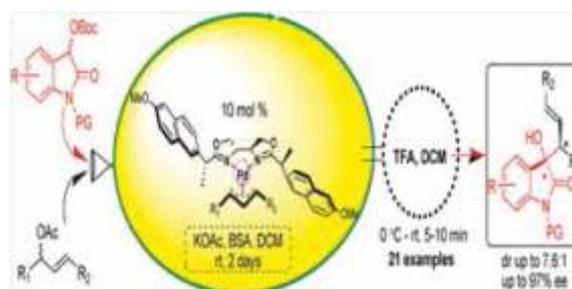
Principal Collaborators



V. Kesavan
Indian Institute of Technology Madras
Chennai



Philippe Loiseau
Université Paris-Sud II
Chatenay Malabry



3-Allyl-3-hydroxyoxindoles were synthesized in very good enantio- (up to 97% ee) and diastereo selectivities (dr up to 7.6:1) with contiguous quaternary and tertiary stereogenic centers by employing tartrate derived bi(oxazoline) in Pd catalyzed allylation of 3-O-Boc-oxindole

Publications

- No. of publications in SCI journals : 3
- No. of papers presented in conferences: 7

Mobility Support

- India to France: 2
- France to India: 2

Pure and Applied Physics

RESEARCH AND DEVELOPMENT OF MICROMEGAS DETECTOR AND RELATED DEVICES

Project No. 4304-1

Apr. 2011 to Mar. 2016

Background

The proposal aimed to carry out research and development of a new generation micropattern gas detector, Micromegas, and Micromegas-based Time Projection Chamber devices. The detector, demonstrating excellent position, timing and energy resolution, has drawn significant attention among other micropattern detectors. It has tremendous potential in tracking and imaging and the proposed R&D program is expected to contribute to the improvement of the Micromegas to cope up with the challenges of future generation applications in areas starting from high luminosity colliders to medicines. The proposal emphasizes basic R&D development of the Micromegas and related devices, reinforced by an extensive simulation program, to study its application in the future colliders like ILC or LHC and in the field of rare event detection.

Objectives

- To design, construction, operation, performance of the TPC device (a small TPC with standard pads of a few mm² size) for an in-depth understanding of its intrinsic properties like dynamic range, gain stability, rate capability, detection efficiency etc. and related physics issues, such as, signal induction, space charge effect, discharge, ion backflow etc. and to optimize the design and the operational parameters of the TPC device and to increase its efficiency following the requirement of a specific application
- To study the power dissipation of the electronics of ILC TPC the size of which will be fitted to enter the bore of a 5T magnet available at DESY
- To investigate the development of a device for low background experiments where construction of a large volume detector with less material is necessary for particle tracking in reduced background
- To carry out a detailed detector simulation of the Micromegas-based TPC using standard detector simulation code such as GARFIELD [Garfield] or GEANT4 [Geant4] where the field simulation part would be carried out by the neBEM. Refinement of the neBEM solver may be carried out during the process as necessary

Knowledge Generated / Products Developed

- Micromegas detector operation: geometrical and operational parameters of Micromegas was studied both in experiments and in simulation, leading to a deep understanding of the various parameters that play on observable properties as gain, resolution, ion back-flow, sparking rate, etc. An entire laboratory was developed at SINP to this end, and dedicated software was written
- Track distortions have been calculated in inhomogeneous electric and magnetic fields, including module-edge effects. This led to ideas for mitigating these distortions

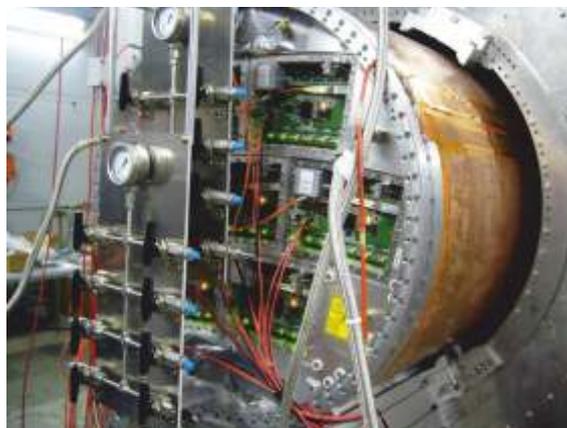
Principal Collaborators



Supratik Mukhopadhyay
Saha Institute of Nuclear Physics
Kolkata



Paul Colas
CEA/IRFU Saclay
Gif sur Yvette



The Large Prototype equipped with 7 Micromegas modules and the 2-phase CO₂ cooling system

Publications

- No. of publications in SCI journals : 6
- No. of papers presented in conferences: 8

Mobility Support

- India to France:6
- France to India:1

Pure and Applied Physics

SLOW HIGHLY CHARGED ION MOLECULE COLLISIONS

Project No. 4604-2

Dec. 2011 to Nov. 2015

Background

The project proposal was for the interaction of highly charged ions with neutral molecular targets at very low energies. Such studies are important in understanding the dynamics and kinetics of processes occurring in both man-made and natural environments. For example, the secondary ions produced in the interaction of cosmic rays, solar wind and energetic photons in the upper atmosphere, interacting with the rest of neutral gas molecules. A knowledge of the fundamental processes taking place in such conditions were proposed to help in a detailed understanding of the phenomenon like the ozone hole etc. Several man made plasma environments like those present in plasma processing of materials were also proposed to be better understood.

Objectives

To study and understand the interaction of very slow highly charged ions with atoms and molecules. The interaction of highly charged ions with matter, in the form of atoms, molecules, clusters and bulk matter is a region of much contemporary interest. The present proposal was to study of the interaction of “slow highly charged ions” with “atoms and molecules” with focus on electron transfer and fragmentation dynamics.

Knowledge Generated / Products Developed

- Decelerated highly charged ion beams created
- Experiments on collisions of ions with neutral molecules and dimers
- Plasma potential measurement
- Irradiation of Cytochrome c by slow ions
- Detector developments and simulations on pulse extraction
- The availability of very slow (eV) energy ion beams is a unique achievement at both the facilities

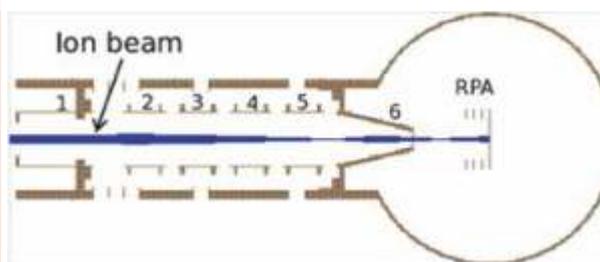
Principal Collaborators



C. P. Safvan
Inter-University Accelerator Centre
New Delhi



Amine Cassimi
Centre de Recherche sur les Ions,
les Matériaux et la Photonique (CIMAP)
Caen



Simulation for optimization of the voltages on the electrodes of the deceleration lens; 1–6 are the electrodes of the lens. It also shows the deceleration lens and RPA used in unison to measure the plasma potential

Publications

- No. of publications in SCI journals : 1
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 4
- France to India: 3

Pure and Applied Physics

TWO-DIMENSIONAL ELECTRON GAS PHYSICS IN OXIDE HETEROSTRUCTURES

Project No. 4704-1

May 2012 to July 2015

Background

The aim of the proposal was to make and study epitaxial oxides heterostructures, and more specifically the LaTiO₃/SrTiO₃ system, where an electrostatically tunable superconducting two-dimensional electron gas (2DEG) had been discovered by the partners. In a first step, it was proposed to study the phase diagram of this system by changing the carrier density, and the superconducting to insulator transition analyzed. In second step, ultra-thin films (below 5 unit cells) of the Mott insulator LaTiO₃ were to be grown on SrTiO₃. Following calculations, such a system would present electronic orders different from the bulk ones due to strong correlations. An adjustable LaMnO₃ spacer was also proposed to be used to decouple LaTiO₃ and SrTiO₃. Finally, Mn and Co doped LaTiO₃ thin layers were proposed to be grown to study the impurity Kondo problem in this possibly correlated 2DEG. This work is related to more general context of “oxytronics” that is making new devices and functions with oxides heterostructures.

Objectives

- Phase diagram of the superconducting 2DEG in LaTiO₃/SrTiO₃ interfaces
- Electronic correlations in LaTiO₃/SrTiO₃ based heterostructures
- Doping LaTiO₃/SrTiO₃ structures with Mn or Co

Knowledge Generated / Products Developed

- Precise controlled unit cell growth of epitaxial LAO/STO and Cr doped LAO/STO using pulsed laser deposition technique with *in-situ* RHEED
- Successfully grown ultra thin (6uc) films and probed the interface with X-ray photo emission spectroscopy (XPS) in order to understand the metal to insulator transition with Cr doping
- XPS studies on ultrathin hetero-interfaces of 6 unit cell LaAl_{1-x}Cr_xO₃/SrTiO₃ revealed that the origin of q-2DEG is associated with Ti₃₊ states and that it ceases to exist with increasing Cr ion concentration in the over layer films
- In photoconducting investigation, increase in both photo-response and relaxation time with Cr doping was observed. In addition an anomalous peak was observed at 690nm
- Study of the interplay between Superconductivity, Spin orbit coupling and Kondo effect on Cr-doped LAO/STO interfaces. Role of the electrostatic doping was explored
- Discovery of a new type of superconducting fluctuations with an anomalous dynamics driven by density fluctuations ($z=3$ and $=1/2$)

Principal Collaborators



Anjana Dogra
National Physical Laboratory
New Delhi



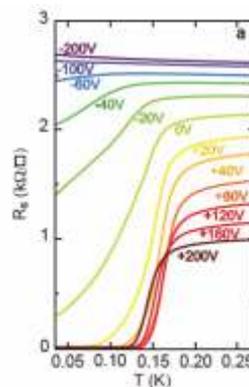
Jérôme Lesueur
Laboratoire de physique et d'étude
des matériaux (LPEM)
Ecole supérieure de physique et de
chimie industrielles (ESPCI)
Paris

Publications

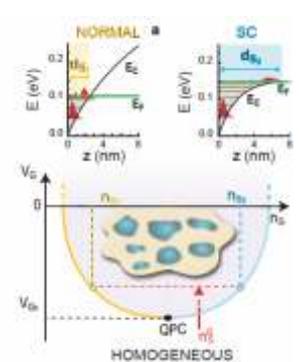
- No. of publications in SCI journals : 17
- No. of papers presented in conferences: 11

Mobility Support

- India to France: 3
- France to India: Nil



R(T) curves of a LAO/STO interface for different back-gate voltages showing the superconductor-insulator quantum phase transition



Scheme of the electronic phase separation which could explain the anomalous fluctuation dynamics observed

DEVELOPMENT OF CARBON NANOTUBE-METAL HYBRID CATALYSTS

Project No. 4705-1

May 2012 to Oct. 2015

Background

The proposal dealt with novel supported catalytic systems based on carbon nanotube (CNT) metal assemblies and their evaluation in various organic transformations. The devised approach lays on supramolecular nanoring assembly and polymerization of specific amphiphiles on the nanotube surface to connect e-beam grown metallic nanoparticles. Various noble metals were to be explored (e.g. palladium, platinum, gold) either individually or combined in a single nanohybrid (e.g. CNT-Au/Pd) to catalyze multiple transformations. Recyclability and turnover parameters were proposed to be investigated and higher catalytic efficacy of the nanohybrid is expected as CNTs are electronically active and could likely stabilize transient higher oxidation state of the supported metals.

Objectives

- Design and construction of metal catalysts supported on carbon nanotubes (CNT)
- Nanohybrids as catalysts in organic transformations
- Design, synthesis and application of metal-organic nanotube nanohybrid catalysts

Knowledge Generated / Products Developed

- Four different metal-carbon nanotube (CNT) catalysts and one organic nanotube catalyst have been designed and synthesized.
- AuCNT has been employed in oxidation of alcohols, silanes, dihydropyridines, reductive amination of aldehydes, deoxygenation of amine N-oxides, N-formylation of amines and in the synthesis of quinoxalines
- Other metal-CNT catalysts such as PdCNT in Suzuki coupling and Wacker oxidation, RuCNT in selective reduction of nitro groups and subsequent synthesis of heterocycles, RhCNT in dehydrogenation of N-heterocycles and various oxidation reactions and a metal-organic nanotube such as AuONT in oxidative coupling of primary amines have been successfully utilized
- The newly developed catalysts are very efficient in that the reactions can be carried out under extremely mild conditions (room temperature, open air) with very low catalyst loading. Moreover, one catalyst is effective for many transformations and the catalyst is recyclable up to 5 times
- The above features make our novel catalyst systems potential candidates for large scale reactions in a batch and possibly flow setup

Principal Collaborators



Irishi N. N. Namboothiri
Indian Institute of Technology Bombay
Mumbai



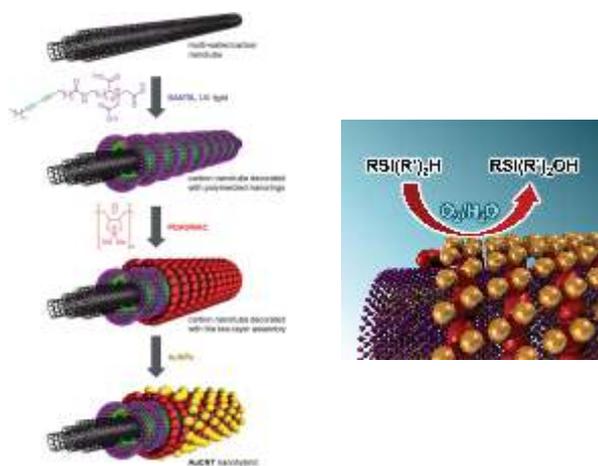
Eric Doris
Commissariat à l'énergie atomique
et aux énergies alternatives (CEA)
Saclay, Gif-sur-Yvette

Publications

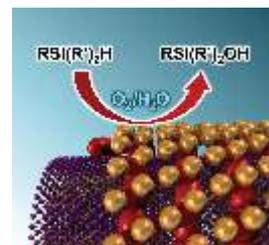
- No. of publications in SCI journals : 20
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 2
- France to India: 3



Synthesis of the AuCNT Assembly



Pure and Applied Chemistry

ALL POLYMER FLEXIBLE GAS SENSORS (FLEXI SENSORS)

Project No. 4705-2

May 2012 to Apr. 2015

Background

Chemi-resistive sensors based on metal oxide semiconductors have been extensively studied for detection of various toxic gases because of their reasonably good sensitivity, stability, and convenience of operation. Nanostructured oxide semi-conductors though exhibit better sensitivity to different gases; their potential for the commercial sensors was hampered by high operating temperatures and lack of selectivity. Conducting polymers are used as gas sensors because their electrical conductivity changes when they come in the contact of analyte gases and have distinct advantages. However, similar to their inorganic counterparts they, too, suffer from lack of specificity, in addition to sluggish response and recovery. To overcome these problems, work was done on a new concept of organic/inorganic hybrid films so that the best of the two worlds namely, metal-oxides and polymers, that could be utilized to obtain highly selective gas sensor.

Objectives

- Develop New strategies to be worked out for covalent grafting of PPy sensing layer on BOPET sheets to ensure proper adhesion
- Enhancement of the selectivity towards target gases to be achieved by tuning the electrical conductivity of sensing layers by embedding various nanostructures (e.g. metal nanoparticles) into the sensing layer
- Morphological, structural and low temperature (20-300K) charge transport studies to be carried out on nanostructure-embedded PPy films to investigate the physics of interaction between nanostructure and PPy recovery, sensitivity and repeatability of flexi-sensors to be investigated
- The developed flexi-sensors to be tested on-line at chemical industries
- To investigate gas sensing mechanism(s) of the flexi sensors using response curve & kelvin probe microscopy; modifying the nature of sensing layer to hydrophobic and on line testing of developed flexi-sensors at chemical industries.

Knowledge Generated / Products Developed

- Synthesis of PPy-Ag films on silanised BOPET sheets by UV induced polymerization for room temperature operated flexi-sensors selective for parts per million (ppm) level detection of NH_3 and H_2S
- New strategies for synthesis of highly ordered free standing PPy-Ag films by photopolymerization.
- Process for synthesis of highly ordered cobalt phthalocyanine thin films on flexible BOPET sheets exhibiting high charge carrier mobility ($\sim 118 \text{ cm}^2/\text{V-s}$) selective for NH_3 chemi-resistive gas sensing.
- Reproducible modification of the flexible ITO coated PEN substrates by diazonium coupling agent for covalent grafting of polypyrrolesilver (PPy-Ag) nanocomposite films
- Design of highly selective chemiresistive gas using hexible gold modified CoPc films

Principal Collaborators



D.K. Aswal
Bhabha Atomic Research Centre
Mumbai



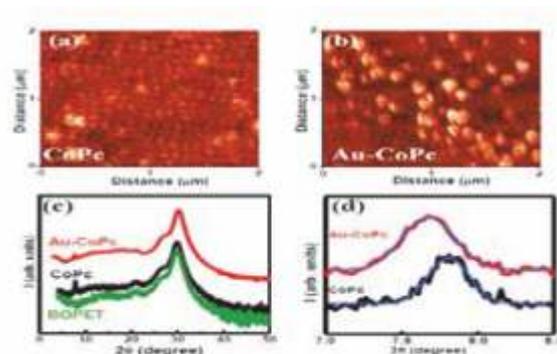
M.M. Chehimi
Université Paris Diderot-CNRS
Paris

Publications

- No. of publications in SCI journals : 3
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 3
- France to India: 3



AFM images of (a) CoPc (b) Au-CoPc films. (c) XRD pattern recorded for CoPc, Au-CoPc films and BOPET samples. (d) Magnified view of the (200) diffraction peak corresponding to CoPc in pure CoPc and Au-CoPc films

Pure and Applied Chemistry

CORRELATED STUDIES OF RESPONSE PROPERTIES OF OPEN-SHELL MOLECULES IN THE RELATIVISTIC FRAMEWORK

Project No. 4705-3

May 2012 to Nov. 2015

Background

The overall objective was to develop computational tools for the study of reactivity and properties of molecules containing heavy elements. Such complexes often display complicated electronic structure. Actinides in particular have several features such as numerous energetically close orbitals and significant relativistic effects making them a challenge for theoretical chemists. It was proposed to address these challenges by consolidated and successive developments of high level of correlation theory combined with relativistic corrections.

Objectives

- To develop computational tools for the study of reactivity and properties of molecules containing heavy elements
- Successive developments of state-specific(SS) multi-reference (MR) perturbation theory (PT), the Coupled Electron Pair Approximation(CEPA) and Coupled Cluster(CC) with the possibility of calculating both first-and second-order properties

Knowledge Generated / Products Developed

- Development and implementation of a suite of many-body theories to treat strong electron correlation, both for studying potential energy surfaces and precision spectroscopy in a spin-free manner and for understanding and interpreting core-ionization and core-excitation spectroscopy, dovetailing the formulations from both the Indian and the French sides
- Generalization of the above theories to include scalar relativistic effects for systems with medium heavy atoms
- First 4-component relativistic coupled cluster code for the calculation of expectation value which includes spin-orbit coupling from the start
- Simulation of X-ray absorption spectra of heavy element compounds in a fully relativistic manner
- New state-of-the-art theories at the frontier of electron correlation theories and relativistic quantum chemistry. Insights into the role of relativity in conjunction with electron correlation
- Development of the property package for relativistic coupled-cluster in DIRAC
- MRCC theory codes interfaced to DIRAC

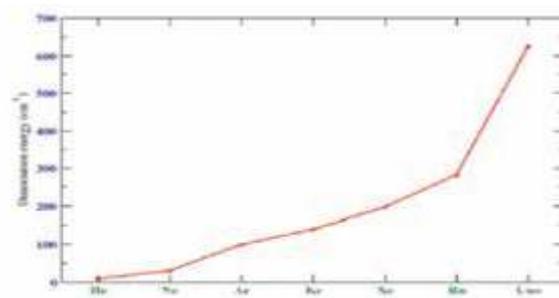
Principal Collaborators



Ankan Paul
Indian Association
for the Cultivation of Science
Kolkata



Trond Saue
Université de Toulouse 3 (Paul Sabatier)
Toulouse



Dissociation energies D_e (in cm^{-1}) for the homonuclear rare gas dimers. The first five data points are derived from experiment, 83 whereas the final two points correspond to the values obtained in the present work with the $X2_{\text{M4}}^{\text{DC}}$ Hamiltonian at the CCSD(T) level and extrapolated to the basis set limit

Publications

- No. of publications in SCI journals : 7
- No. of papers presented in conferences: 6

Mobility Support

- India to France: 6
- France to India: 3

Pure and Applied Chemistry

SUPRA-MOLECULAR APPROACH TO COMPOSITE MATERIALS FOR ADVANCED TECHNOLOGIES

Project No. 4805-1

Jan. 2013 to Mar. 2016

Background

Materials with functionality controlled by molecular composition and order can revolutionise soft solvated materials or optical nano-structured materials. Bottom-up approaches using self-assembly are the most appropriate routes for the synthesis of gel-phase soft materials, copying the advantages of biological systems but exploiting synthetic accessibility and robustness. Nano and micro-structures controlled in size, shape, order, stiffness, optical stability and tunability are challenges that can individually be overcome but seldom achieved simultaneously. It was proposed to combine the best of both worlds' to design and develop original molecular systems that induce a synergy between organic and inorganic building blocks. It was expected to develop functional materials with novel emergent properties for high-tech applications, for example in photonics and opto-electronics.

Objectives

- Establish novel fundamental principles for the preparation of the following functional hybrid and composite materials:
 - o emissive hybrid gels using bile derivatives, acenes, salts and/or lanthanides
 - o composite gels from bile derivatives, acenes and nanoparticles
- Develop aerogels and composite materials in supercritical fluids by original specific design of fluorinated derivatives
- Perform rare advanced characterization, including structural characterization by X-ray and neutron scattering, and high-resolution optical microscopies
- Evaluation of the potential applications, including in the fields of rheologic tuning of liquids and gels, photonics and energy

Knowledge Generated / Products Developed

- Composite organic/inorganic nanofibers displaying dual-color dual-polarization emission were obtained using CdSe-CdS nanorods and 2,3-didecyloxyanthracene (DDOA)
- Alignment of nanorods in space was achieved exploiting supramolecular interactions with gel nanofibers
- High quality CdSe QDs showing narrow distribution in sizes and high photoluminescence efficiencies were synthesized in microfluidic supercritical fluids at gram scale
- Original CdSe-CdS nanocubes and high quality CdSe-CdS nanorods with narrow distribution in sizes and high photoluminescence efficiencies were synthesized using micro-millifluidic supercritical fluid technology and in conventional batch reaction
- The potential application of single-nanorod fluorescence polarization microscopy was demonstrated for the first time for the imaging of finely nano-structured surfaces

Principal Collaborators



Uday Maitra
Indian Institute of Science
Bangalore



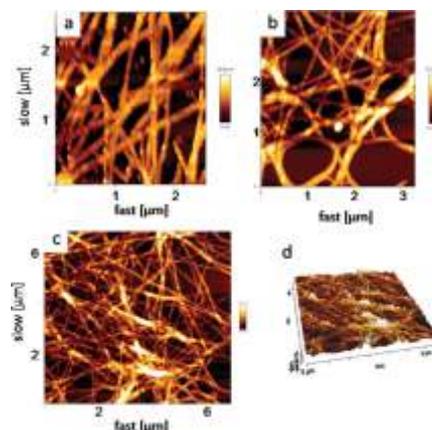
André Del Guerso
Université de Bordeaux
CNRS UMR5255
Talence

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: 18

Mobility Support

- India to France: 3
- France to India: 4



AFM images (a) XG, (b, c) XG-Pd and (d) 3D view of XG-Pd, formed on mica sheets from the wet hybrid gel

Materials Science

DEVELOPING DESIGN GUIDANCE FOR RAMMED EARTH CONSTRUCTION

Project No. 4608-1

Nov. 2011 to Oct. 2015

Background

There is a need for evolving low embodied carbon construction materials in order to reduce GHG emissions. Rammed earth is a low embodied carbon and eco-friendly construction material, which utilizes local soil resources. There is a lack of standardized testing procedures for assessing the strength of rammed earth walls. Currently available codes of practice on rammed earth lack proper design guidance. The novelty of the project was to standardize the testing procedure for evaluating the strength of rammed earth and to develop design guidance. The outcome of the project was to help the professionals involved in promotion of rammed earth constructions.

Objectives

The project focuses on the following aspects of un-stabilised rammed earth (USRE) and Cement stabilised rammed earth (CSRE):

- Standardising specimen size for assessing the characteristic compressive strength. Variables: Soil grading, density and cement content
- Establishing stress strain relationships and elastic constants (modulus, Poisson’s ratio, etc.) considering soil grading, density and cement content as variables
- Examining compressive strength of CSRE and USRE with different slenderness ratios and load eccentricities, for deriving stress reduction factors
- Examining behaviour of rammed earth elements under lateral loads in order to assess the behavior under seismic or wind loads
- To establish design methodology for rammed earth structures and the development of code of practice on design of rammed earth

Knowledge Generated / Products Developed

- Established stress-strain characteristics for CSRE. Standardised the specimen size for assessing the characteristic compressive strength of CSRE. Examined the role of moulding moisture content on mechanical characteristics of USRE
- Establishing stress reduction factors for CSRE considering different specimen slenderness and load eccentricities
- Evaluated through experiments the flexural strength and damping properties of CSRE elements in the two orthogonal directions
- Developed a shear test device which enables testing the shear strength of rammed with pre-compression

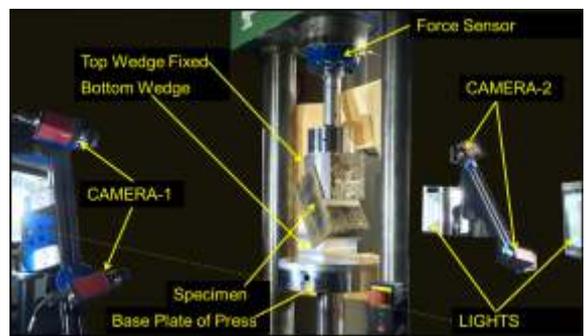
Principal Collaborators



B. V. Venkatarama Reddy
Indian Institute of Science
Bangalore



Jean-Claude Morel
Laboratoire Génie Civil et Bâtiment (LGCB)
École Nationale des Travaux Publics de l’État (ENTPE), Vaulx en Velin



Shear test set-up (specimen, wedge and cameras)

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 3
- France to India: 1

THE KOSI RIVER ALLUVIAL DYNAMICS AND ASSOCIATED RISKS

Project No. 4500-W1

Jan. 2012 to Dec. 2015

Background

The project site was located in north Bihar India and was looking at the Kosi river which has built the largest alluvial fan in the world and is also known for raid and frequent avulsion. The project was making use of physical models and cellular automatas of alluvial fans and braided streams and their application on the field to the study of the dynamics of the Kosifan system in north Bihar, India.

Objectives

The objective of the project was to study the dynamics of an alluvial fan building and evolution with a special emphasis on avulsion dynamics

- To understand the historical-scale dynamics of the Kosi alluvial fan through numerical modeling and flume experiments
- To estimate the modern sediment flux in the Kosi river and relate this to morphological changes e.g. Channel aggradation and flooding
- To understand the alluvial architecture and long-term (pre-historic) avulsion history of the Kosi river through geophysical surveys and shallow coring
- To estimate pre-historic sediment flux in the Kosi fan using geochemical (isotopic) methods and to understand the forcing functions (climate-tectonics coupling)
- To develop long-term strategy for river management in this region based on process response system

Knowledge Generated / Products Developed

- Understanding of fundamental controls on river morphology particularly in terms of multi-thread systems
- Understanding of pre-historic river dynamics from alluvial architecture
- Development of novel method for discharge estimation through satellite images
- Development of criteria for avulsion threshold based on morphological characteristics
- Understanding of evolutionary processes for fan development

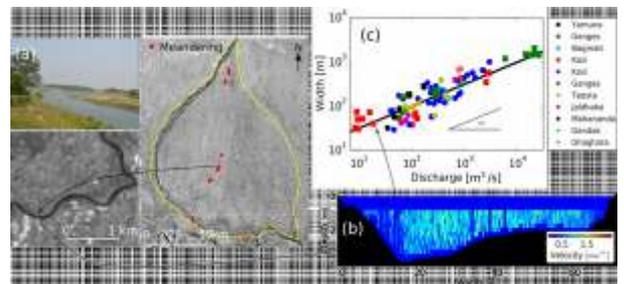
Principal Collaborators



Rajiv Sinha
Indian Institute of Technology
Kanpur



François Métivier
Institut de Physique du Globe de Paris
(IPGP)
Paris



(a) Location and morphology of a channel surveyed on the Kosi Fan. (b) ADCP profile of the channel surveyed from which the geometry and discharge are extracted. (c) correlation between width and discharge performed over numerous measurement sites. The profile shown in b corresponds to one point in (c)

Publications

- No. of publications in SCI journals : 3
- No. of papers presented in conferences: 7

Mobility Support

- India to France: 4
- France to India: 6

Materials Science

MECHANISMS OF NEW LONG-LASTING LUMINESCENCE BIOMARKERS

Project No. 4508-1

July 2011 to June 2015

Background

The proposal aimed at developing novel biomarkers emitting red Long-Lasting Phosphorescence (LLP) for *in vivo* small animal optical imaging. The biomarkers are first excited by ultraviolet light for a couple of minutes outside the animal body, then injected to the animal, where they emit red/infrared light detectable for 1h after the injection. The proposal was to elucidate the persistent luminescence mechanisms of red-emitting LLP materials. The emphasis was supposed to be put on combined studies of local structure (X-ray absorption techniques, Electron Paramagnetic Resonance) and optical characterization (Thermally Stimulated Luminescence) to identify the defects/dopants responsible for LLP. The knowledge of mechanisms was to contribute to design new LLP biomarkers with improved LLP properties, i.e. showing red/infrared intense and very persistent luminescence, in order to develop a novel cost-effective and powerful technique of *in vivo* imaging.

Objectives

- To develop red-emitting long-lasting phosphorescence (LLP) materials for an application of *in vivo* imaging
- To elucidate persistent luminescence mechanisms of red emitting LLP compounds through a combined study of their optical properties
- To develop new red/infrared LLP materials suitable for the very exciting application of *in vivo* imaging

Knowledge Generated / Products Developed

- Developed new long lasting phosphorescence (LLP) materials, $ZnGa_2O_4:Cr_3^+$ and $MgGa_2O_4:Cr_3^+$ suitable for bioimaging
- These materials show excellent LLP not only with X-rays or UV excitation but also with visible light excitation
- This has a great implication in bioimaging as the biomarker can now be re-excited from within the animal body thereby enhancing the detection time
- The mechanism of LLP induced by visible light excitation is entirely localized around Cr_3^+ ion with an antisite defect in its first cationic neighbour
- Presence of Cr-O-Cr linkages (Cr clusters) however, is detrimental to observation of visible light induced persistent luminescence

Principal Collaborators



Kaustubh R. S. Priolkar
Goa University
Goa



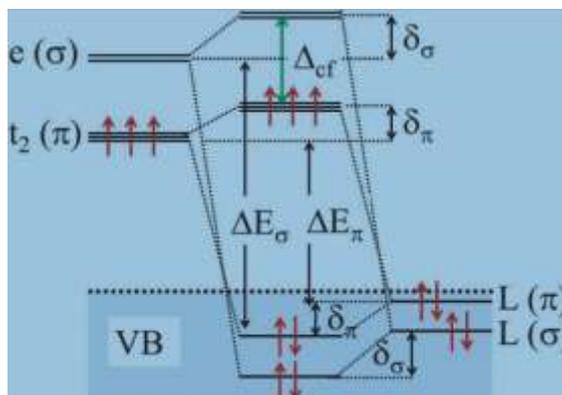
Aurélie Bessiere
Laboratoire de Chimie de la Matière
Condensée de Paris
Paris

Publications

- No. of publications in SCI journals : 10
- No. of papers presented in conferences: 9

Mobility Support

- India to France: 5
- France to India: 3



Energy level scheme representing the effect of s and p contributions to the Cr-O bond.

Environmental Science

CONTROLLING FOR UPSCALING UNCERTAINTY IN ASSESSMENT OF FOREST ABOVE GROUND BIOMASS IN THE WESTERN GHATS OF INDIA

Project No. 4509-1

Feb. 2013 to May 2017

Background

The aim of the project is to assess uncertainty in evaluation of forest aboveground biomass at critical steps of the upscaling process from local forest data to regional extrapolations, in order to improve large-scale biomass and carbon stock assessments. It focuses on the humid forests of the Western Ghats of India, for which field data, satellite images and detailed vegetation maps are available. The project is an accompanying research of the National Carbon Project (NCP). It is also part of a research programme, which searches for a pertinent integration of the allometric theory of plants with 3D simulations of forest stand dynamics and canopy texture analysis in order to predict properties of forest stands at multiple spatial scales. The project has great potential applications within the framework of NCP and more generally within the UN-REDD programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries.

Objectives

- The main objective of the project is to assess uncertainty in evaluation of forest aboveground biomass (AGB) at critical steps of the upscaling process from local forest data to regional extrapolations, in order to improve large-scale biomass and carbon stock assessments
- The specific objectives are:
 - Conversion of tree measurements into plot-level AGB estimates
 - Prediction of nominal forest-type AGB densities
 - Landscape-scale extrapolation of AGB estimates

Knowledge Generated / Products Developed

- Evaluation of plot-level allometric AGB models
- HR Satellite data acquisition and analysis
- Forest-type classification using various resolution satellite data and vegetation maps
- Field data collection and analysis
- 3D simulations of stand structure variations

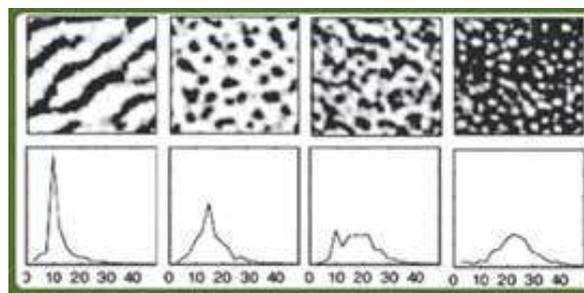
Principal Collaborators



Vivek Dadhwal
National Remote Sensing Centre (NRSC)
(ISRO)
Hyderabad



Pierre Couteron
UMR AMAP Botanique et
bioinformatique de l'Architecture des Plantes
Montpellier



Examples of the main morphologies of spatically periodic semiarid patterns from optical HSR images (top panel) and associated Fourier r-spectra (bottom as observed in the Sudan study area in Deblauwe et al. (2011)). In the bottom row, abscissa are spaitial frequencies (cycles km²) while ordinaies feature rescoled r-spectra. Note the shift of the mode from left to right that contributes to the automatic disartmination and mapping of the morphologies (the dominant wavelength systematically decreases from spols to labyrinths and to gaps)

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: 3

CATECHOLESTROGENS IN FISH REPRODUCTIVE ENDOCRINOLOGY

Project No. 4603-3

May 2013 to Oct. 2016

Background

While world demand for fish and seafood is expected to grow steadily, capture fishery production remains relatively static since the late 1980s. In India, the global fish demand could increase by one third by 2030. World aquaculture now provides around half the fish for direct human consumption (49.8 million tonnes of finfish in 2014) and should be able to fit with the future demand (estimated to 94 million tonnes in 2030 by FAO under a baseline scenario). One major step in fish farming is the proper control of fish reproduction especially when developing selective breeding. The present project aims to bring very new original knowledge on the endocrine regulation of female reproduction. It has been chosen to focus at a molecular level on the synthesis and action of catechol-estrogens, which are a major group of active natural estrogen metabolites although very few studies exist in non-mammalian vertebrates.

Objectives

- To explore whether CEs are synthesized in trout gonads like in catfish
- To analyze the potential effect of CEs on trout in vitro oocyte maturation
- To analyze the in vitro effect of physiological doses of CEs on the transcriptomes of both catfish and trout ovary and trout embryonic gonads using homologous oligonucleotide microarray technology
- To get information on the effect of CEs on the expression of some major steroidogenic enzymes using quantitative real time polymerase chain reaction (qPCR)
- To propose new models, including CE, for the estrogen implication in fish oocyte maturation and sex differentiation regulation

Knowledge Generated / Products Developed

Catechol-estrogens (CE) were shown ineffective on trout ovary unlike catfish ovary

- Molecular cloning and characterization of major catfish enzymes involved in catechol-estrogens metabolism (*cyp1a1*, *cyp1b1* and *comt*) was achieved
- mRNA of *cyp1a1*, *cyp1b1* and *comt*, and *cyp1a1* and *comt* proteins were localized in the follicular layer of the catfish ovary
- Developmental stage-dependent expression of *cyp1a1*, *cyp1b1* and *comt* was completed in the catfish
- Gonadotropin (hCG) and 2-hydroxyestradiol-17 β (CE) were shown to up regulate *cyp1a1*, *cyp1b1* and *comt* gene expression during oocyte maturation
- A new oligonucleotides micro-array has enabled to analyze changes in catfish ovary transcriptome under 2-hydroxyestradiol-17 β exposure

Principal Collaborators



Radha Choube
Banaras Hindu University
Varanasi



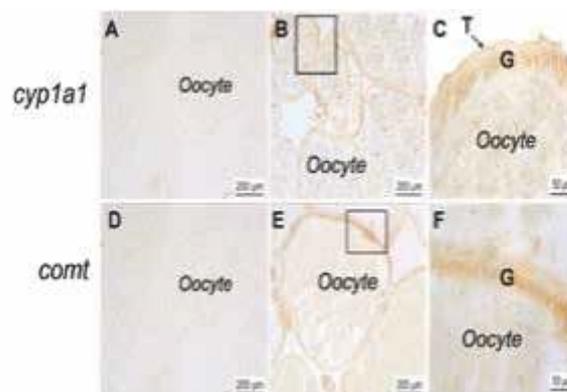
Alexis Fostier
Institut National de la Recherche Agronomique
INRA-SCRIBE
Rennes

Publications

- No. of publications in SCI journals : 1
- No. of papers presented in conferences: 4

Mobility Support

- India to France: 2
- France to India: 0



Sections of vitellogenic follicles in the ovary of catfish showing immunolocalization of *cyp1a1* (B&C) and *comt* (E&F) in the follicular layer. A and D are controls. T – thecal layer, G – granulosa layer

REAL-TIME IMAGING THROUGH FOR OVER LONG DISTANCE (RTIFOLD)

Project No. 4604-4

Oct. 2012 to Jun. 2016

Background

Photons in turbid media are randomly scattered, losing their direction of propagation and polarisation, and thus their imaging capabilities. Methods devised so far to extract images need sophisticated equipment or enormous computational time. Polarisation-based imaging, an elegant and inexpensive technique, can provide 2D images, but not in real-time. With the availability of powerful yet cheap sources of light that may be electronically controlled, inexpensive fast cameras and portable devices with high computing capabilities, real-time long range imaging using ballistic photons now appears feasible. The project aims at obtaining visual images of a source despite intervening strongly scattering media. Innovative ideas on source modulation, detector synchronization and sampling, particularly suited for aircraft navigation, will be implemented in the field, in actual fog, and over ~ kilometer. This project will also provide data on atmosphere scattering, which is lacking in literature, and will help optimize existing theoretical models.

Objectives

The objective of the project is to develop a real-time, long-range imaging system providing visual assistance under low visibility conditions. The path of light in a heavily scattering medium (like fog, dust, suspension of particles, etc.) tends to be diffusive rather than ballistic, thereby rendering direct viewing or imaging through such media difficult. For this purpose, two imaging techniques will be explored, implemented, tested and optimized. Both techniques are based on the detection of ballistic photons, i.e. the potentially few photons that have not been scattered (or have been marginally scattered) by the diffusive medium. The first one is based on the use of polarised light, while the other technique will involve the use of a modulation technique, varying either the light polarisation state or its intensity

Knowledge Generated / Products Developed

- Developed camera-control and automation software for imaging in any weather condition
- Developed rugged high-polarimetric source that can be in the field in all weather
- Optimised choices of polarimetric representation for contrast enhancement under different weather conditions
- Realization of unsuitability of intensified cameras for sub-sampling imaging due to unacceptable signal-to-noise ratio and dynamics for long-range viewing through fog
- Simulations confirmed speedup of data-processing by use of matched filtering for image retrieval of intensity-modulated light sources, instead of the usual Fourier decomposition. This is to be used in real situations
- Invention and development of an apparatus for imaging through turbid media using high-frequency modulated light (under patent procedure)

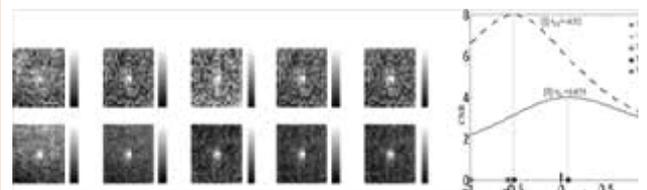
Principal Collaborators



Hema Ramachandran
Raman Research Institute
Bangalore



Mehdi Alouini
Institut de Physique de Rennes
Université de Rennes 1
Rennes



(a) Comparison of the contrasts obtained for three representations of the polarimetric images for frames labeled as [I] and [J] in figure 1(b). The source region, is bounded by the 3 × 3 pixels red square and is the background region between the two blue squares of sizes 11 × 11 pixels and 21 × 21 pixels. (b) CNR-maximizing 1D search over values of v keeping $u = 1$ for the two frames

Publications

- No. of publications in SCI journals : 2
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 2
- France to India: 2

Environmental Science

NUTRIENT SENSING IN PLANTS

Project No. 4609-1

Mar. 2013 to Aug. 2016

Background

Food production should increase by 40% by 2050 to cope with the growing population. Two restrictions of increasing production yield has been studied case by case: (i) the presence of salt (Na+) in at least 20% of irrigated land worldwide, which impairs crop production and (ii) the effect of nitrate on both plant growth and development. The project is supported by the interaction between nutrition and stress tolerance and specifically the role of nitrate in such mechanisms. The signal transduction pathways involving the CIPK, a family of kinase interacting with a calcium sensor (CBLs) will be studied in *Arabidopsis*. The aim of the project is to understand the signalling network that exists between these two ions to increase the knowledge of salinity tolerance in plants.

Objectives

A new nitrate transporter has been identified, NPF5.5 by functional expression in xenopus oocyte. The NPF5.5 gene is expressed in the embryo and is involved in nitrogen accumulation. An objective of the upcoming year is to analyse the role of this transporter in plant sodium sensitivity

Knowledge Generated / Products Developed

- i) Cloning of CBL1, CBL9, NPF5.5 and NRT1.1/NPF6.3 genes have been completed
- ii) Seeds of the KO mutants have been multiplied. Salinity stress induces reduction in primary root length in all genotypes. The lateral root number were decreased in all the mutants and increased in wild type under stress
- iii) Corona Green based sodium localization study identified CBL9 and CIPK23 as putative salinity sensitive mutants because their root accumulates higher sodium
- iv) Nitrate modifies the sodium sensitivity of plants
- v) NPF5.5 is expressed in the embryo and is involved in nitrogen accumulation

Principal Collaborators



Narendra Tuteja
Amity University
NOIDA



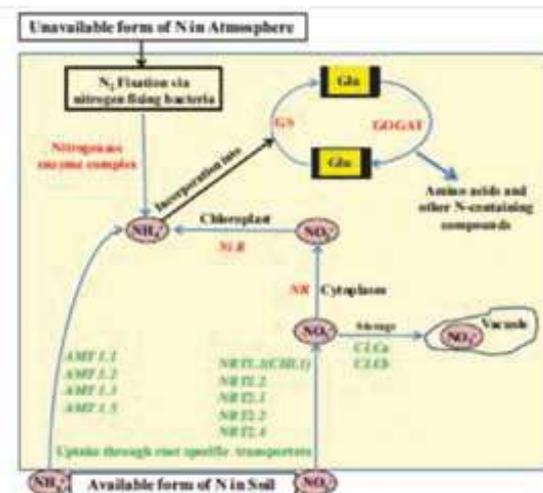
Benoit Lacombe
Biochimie et Physiologie Moléculaire des
Plantes CNRS/INRA/SupAgro/UMII
Montpellier

Publications

- No. of publications in SCI journals : 5
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: Nil



Computational Science

ARITHMETIC CIRCUITS COMPUTING POLYNOMIALS

Project No. 4702-1

May 2012 to Apr. 2016

Background

The aim of this project is to better understand arithmetic circuit computations of polynomials and related counting and enumeration complexity questions, organised along three main axes:

- Proving lower bounds for restricted models of computations (multilinear branching programs), with a particular focus on the computation of the determinant.
- Finding new natural complete polynomials for the classes in the general theory defined by Valiant, in particular for the class of feasible computations VP, and understanding the role of the characteristic in results of VNP completeness.
- Defining or refining notions of reduction, completeness, parallel complexity, space bounded complexity for enumeration and studying enumeration questions related to polynomials computed by circuits.

Objectives

- Proving lower bounds for restricted computation models
- Capturing completeness of complexity classes (specifically, the class VP) via natural polynomial families
- Exploring the complexity of enumerating monomials

Knowledge Generated / Products Developed

- Establishing that the iterated matrix polynomial $IMM(n,d)$ has no depth 4 formulas of different kinds. These results show that a recent upper bound by Tavenas (MFCS 2013) is tight and improve the lower bound of Nisan and Wigderson from 1997
- Showing VP-completeness of a polynomial family that is a variant of the polynomial that generalises counting graph homomorphisms, the first known example of a natural VP-complete polynomial
- Initiating a study of enumeration complexity for monomials of readrestricted formulas
- Extending Nisan's non-commutative lower bounds to two different stronger models, thus getting the strongest noncommutative models for which there is a superpolynomial lower bound
- Obtaining lower bounds for depth-4 formulas computing the elementary symmetric polynomials, generalizing Nisan and Wigderson's bounds

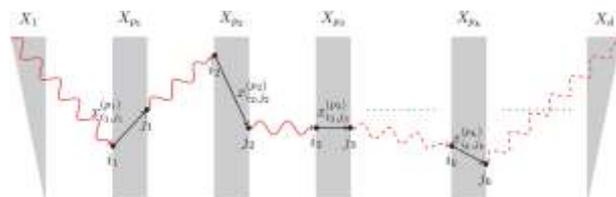
Principal Collaborators



Meena Mahajan
The Institute of Mathematical Sciences
Chennai



Guillaume Malod
Institut Mathématique de Jussieu
Université Paris Diderot - Paris



The derivatives of $IMM_{n,d}$

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 4
- France to India: 7

Life & Health Sciences

INTEGRATING Hox AND CHROMATIN MEDIATED TRANSCRIPTIONAL REGULATION

Project No. 4703-2

Jun. 2013 to May 2016

Background

How only a handful of highly specific transcription factors, the Hox proteins, accomplish rich functional diversity still remains poorly understood. Previous approaches on understanding their mode of action have focused mainly on studying how protein partners of the PBC and Meis family of sequence specific transcription factors influence Hox target gene recognition. As chromatin and not naked DNA is the in vivo template for Hox proteins, it is proposed to investigate how chromatin regulators mediate Hox protein function. According to the collaborators this may be the first attempt at merging Hox-mediated and chromatin-mediated control of transcription. Target gene selection and regulation by transcription factors is a highly coordinated series of events, including chromatin modification and functional interaction with the regulatory elements. The project aims to facilitate the understanding of these orchestrated events by better defining how Hox proteins function in the highly complex chromatin environment.

Objectives

- To better understand how the evolutionary conserved Hox transcription factors, with broadly recognised functions in development and disease, control gene expression by investigating the interplay with chromatin features and regulators

Knowledge Generated / Products Developed

- Characterisation of Hox chromatin interplays for gene regulation in Drosophila S₂ cells
- Discovery and characterisation of Hox associated PTMs and protein domains: functional and structural characterisation
- Discovery and characterisation of a Hox generic function in the Drosophila fat body: repression of autophagy
- Defining the chromatin landscape for Hox generic functions
- Functional relevance of abdA in the posterior domain where identity is determined by AbdB

Principal Collaborators



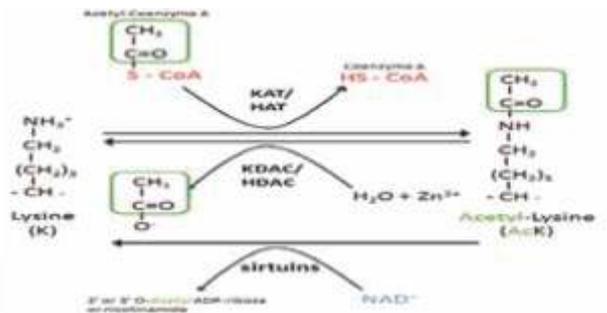
Rakesh K Mishra

Centre for Cellular and Molecular Biology
Hyderabad



Yacine Graba

Institute for Developmental
Biology Marseille Luminy (IBDML)
Campus Universitaire de Luminy
CNRS Case 907
13288 Marseille



Acetylation control by KATs-HATs and KDACs-HDACs. Acetylation and deacetylation of proteins at lysine residues are mediated by lysine acetyltransferases (KATs or HATs) and deacetylases (KDACs or HDACs). KATs/HATs transfer an acetyl-group of acetyl-CoA to the ε-amino group of an internal lysine residue. The reverse reaction is mediated by KDACs-HDACs and requires Zn²⁺, whereas sirtuins requires NAD⁺

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 2

Mobility Support

- India to France: Nil
- France to India: 1

Pure & Applied Physics

CORRELATIONS AND TRANSPORT FAR FROM EQUILIBRIUM IN NANOSYSTEMS

Project No. 4704-2

Oct. 2012 to Aug. 2016

Background

The project is on the development of new theoretical techniques to tackle non-equilibrium quantum phenomena in strongly correlated nanoscale systems like for instance interacting quantum dots in the Kondo regime. By means of these techniques, we will study charge- and spin- currents driven by a time-independent bias voltage across the dot and will derive current noises at finite frequency and third cumulant making use of full counting statistics. Examine other ways of achieving non- equilibrium by applying a time-dependent bias or gate voltage. Photo-assisted charge- and spin- noise will be computed for an ac modulation of the external field. Address the issues related to charge and spin dynamics after a fast switching (step pulse) of the gate voltage. The whole results will be discussed in light of recent experiments.

Objectives

The objectives of the project are to study nonequilibrium quantum phenomena in strongly correlated nanoscale systems like for instance quantum dots in which the central region marked by strong correlations is connected to metallic leads. It is proposed to study various sources of non-equilibrium. It is proposed to first consider the application of a time-independent bias voltage between the two leads. It is proposed to study the induced currents and more specifically the noise at finite frequency in the presence of spin independent tunneling between the central region and the leads. The discussion will then be extended to the situation of a modified environment like either injection of a current in one of the leads, which may eventually lead to a spin accumulation, or application of Rashba interactions introducing a spin-flip tunnelling, or presence of a spin dependent tunnelling. Finally, it was proposed to examine other ways of achieving nonequilibrium as the application of a time dependent bias or gate voltage

Knowledge Generated / Products Developed

- Development of a theoretical approach based on equations of motion to study interacting quantum dots in non-equilibrium
- Development of a high-performance numerical code to compute spectral density, electrical current and linear/differential conductances in interacting quantum dots in non-equilibrium
- Predictions for the electrical and thermal transport through a quantum dot when a spin is accumulated in one of the leads by injection of a spin-polarized current. Comparison with the measurements recently made in Japan and discussions with experimentalists
- Predictions for the non-symmetrized finite-frequency noise spectrum in a quantum dot

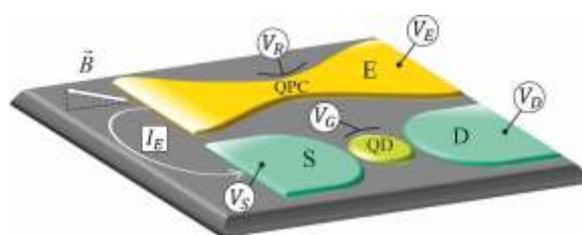
Principal Collaborators



P. Tribhuvan Pareek
Harish Chandra Research Institute
Allahabad



Mireille Lavagna
Institut Nanosciences et Cryogénie INAC
Service de Physique Statistique
Magnétisme et Supraconductivité SPSMS, CEA
Grenoble



Schematic representation of the experimental setup constituted by a QD connected to the two electrodes, sources and drain D, and a QPC responsible for the generation of the current I_E injected from the emitter E into S. An external magnetic field is applied to the system with the plane of the device tilted by a small angle to the axis of the magnetic field

Publications

- No. of publications in SCI journals : 5
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 0
- France to India: 3

Pure & Applied Physics

ROTATING AND CURVED BOUNDARY-LAYER INSTABILITIES

Project No. 4704-3

May 2013 to Jan. 2017

Background

Shear flows display a wide range of instabilities and undergo transition to turbulence by vastly different routes. The dynamics of wall-bounded shear flows determines global flow quantities such as friction coefficients and heat transfer rates. In many practical configurations of interest, fluid flows around objects that are curved and rotating. Curvature and rotation both have a major role in stability and transition to turbulence, but the combination has not been studied very much. The combination is likely to display different behaviour from merely the sum of its parts. The current project is therefore aimed at completely understanding the fundamental dynamics of a geometrically simple prototype of such flows. By bringing together the expertise of the two principal collaborators, linear and nonlinear analyses will be carried out so as to completely characterize the complex three-dimensional dynamics leading to turbulence in this context.

Objectives

While continuing work on the axial flow developing along a rotating cylinder, we are also investigating related flow configurations: the flow through rotating channels and pipes cross flow past a rotating rough cylinder. These configurations all fall into the category of flows which form the focus of the project and their study is expected to better reveal different aspects of dynamics involving rotation and curvature. The mathematical and numerical tools used in these different sub projects are all very similar

Knowledge Generated / Products Developed

- Rotating cylinder, axial flow: Base flow computed, linear stability analysis done
- Rotating channel: Linear stability analysis done, transient growth analysis conducted, nonlinear computations ongoing
- Rotating cylinder, crossflow: Two dimensional simulations ongoing, stability analysis to be conducted

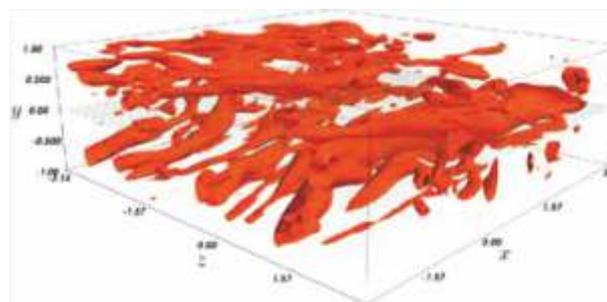
Principal Collaborators



Rama Govindarajan
TIFR Centre for Interdisciplinary Sciences
Hyderabad



Benoît Pier
École centrale de Lyon
(CNRS-Université de Lyon)
Guy-de-Collongue



Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 3

Mobility Support

- India to France: 1
- France to India: 2

Earth & Planetary Science

DEEP STRUCTURE OF THE INDIAN CONTINENT

Project No. 4707-1

May 2012 to Apr. 2016

Background

The present day configuration of the Indian tectonic plate is a consequence of its breakup from the Gondwana supercontinent possibly due to a large plume, about 130 Myr ago. Paleomagnetic data demonstrates that the Indian continent moved northwards from 65Myr at exceptionally high speeds (18-20cm/year) and subsequently slowed down to 4-5cm/year after its collision with Asia \approx 40Myr ago. This super mobility has been explained by an unusually thin Indian lithosphere (\sim 100 km) in contradiction with the thick lithosphere that commonly underlies old cratonic nuclei. It is pertinent to note that the thermobarometric estimates on the ultramafic xenoliths from a 65 Myr kimberlites of the Central India suggest an approximately 175 km thick lithosphere. Also, analysis of heat flow data and P-T estimates on mantle xenoliths from the Dharwar craton reveal low mantle heat flow, 14-20 mW m⁻², that indicate a thick lithosphere beneath south India. In order to solve this apparent contradiction, the collaborators propose a multidisciplinary approach to investigate the lithospheric and asthenospheric structure underneath the Indian cratons and the Indian plate. Seismological studies (receiver functions, SKS and surface waves) in conjunction with heat flow, petrological and paleomagnetic data would be utilised to image the 3D-tomographic velocity and anisotropic structure of the whole continent and trace its evolution through time.

Objectives

- To investigate the causative factors that determine the unique nature of the Indian continent, with emphasis on its origin, deformational history, interactions with Asia and its tectonic evolution, in order to constrain the thermal structure of the Indian shield lithosphere
- The final objectives are to derive a consistent evolutionary model of the Indian continent by synthesising all seismic results and constraints from heat flux, petrological and paleomagnetic data

Knowledge Generated / Products Developed

- Assembled teleseismic data registered at all the Indian broadband seismological stations
- Characterized the seismic structure and deformation through application of recent methodologies (P- and S- receiver functions, SKS splitting)
- Obtained a 3-D anisotropic, heterogeneous mantle model of the Indian continent and surrounding oceans, mapped lateral variations in the lithosphere asthenosphere boundary

Principal Collaborators



M. Ravi Kumar
National Geophysical Research Institute
Hyderabad



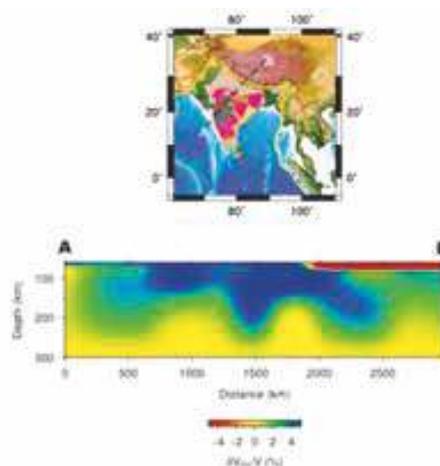
Jean-Paul Montagner
Institut de Physique du Globe (IPGP)
Paris

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 6
- France to India: 6



High shear wave velocity anomaly (bottom) in the Indian plate subducting beneath the Asia along profile AB in map (top)

Environmental Science

GENE RESOURCES FROM POLLUTED SOILS

Project No. 4709-1

Sept. 2012 to Aug. 2016

Background

The originality of the project is to implement a novel environmental genomic approach, the "functional metatranscriptomics" one, which allows the specific characterization of genes expressed by the different eukaryotic microorganisms (eg Fungi, "protists") directly in environmental soil samples. This approach has a strong potential in biotechnology to discover novel genes of interest for the bioindustry, in bioremediation or as biomarkers. The project will allow us to characterize genes implicated in adaptation to stressful conditions or involved in organic matter degradation expressed in stressful environments. The Collaborators will study the metatranscriptoms of selected Indian and French heavy-metal polluted soils for their biotech potential and for adaptation of eukaryotic microbes to heavy metal. To do this, cDNA libraries will be constructed using mRNA directly extracted from the selected soil samples and will be screened by expression in yeast. The collaborators will compare these adaptation mechanisms to those already identified in the Lyon's laboratory from temperate European soils.

Objectives

The objective of the project is to explore, at the gene level, the functional biodiversity of soil eukaryotic microbial communities living in stressful polluted soil environments. This will allow characterization of genes implicated in adaptation to these stressful conditions such as: heavy metal resistance mechanisms but also genes implicated in basic processes such as organic matter degradation under stressful conditions

Knowledge Generated / Products Developed

- A new method for constructing sized eukaryotic environmental libraries was implemented
- Isolated 94 cDNA sequences of which the majority corresponds to new metal-resistance mechanisms
- These sequences were analysed along with cysteine rich proteins-encoding environmental cDNA sequences
- 22 clones tolerant to Cd and 14 clones tolerant to Cobalt were isolated
- Studied the role and induction in presence of metals of several metallothioneins from two basidiomycetes *Laccaria bicolor* and *Pisolithus albus*
- Developed a new process/protocol to construct sized eukaryotic cDNA libraries using low input of total environmental RNA from soil samples

Principal Collaborators



M. Sudhakara Reddy
Thapar University
Patiala



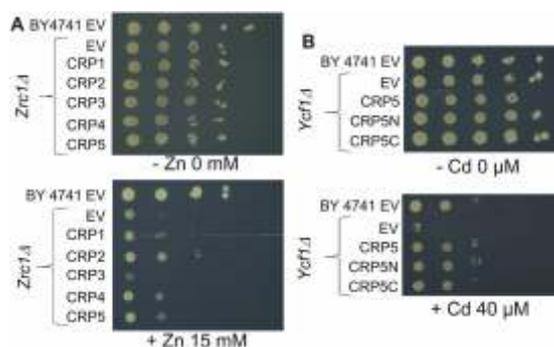
Laurence Fraissinet-Tachet
Université Lyon1
UMR CNRS 5557 d'Ecologie Microbienne
Villeurbanne

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 7

Mobility Support

- India to France: 4
- France to India: 3



Metal tolerance assay of yeast cells expressing full length or truncated CRPs (drop test assays). A. Zn-tolerance assay using the Zn-sensitive *S. cerevisiae* *Zrc1Δ* strain expressing or not (EV=empty vector) the full-length CRP1, -2, -3, -4 or -5 cDNAs. B. Cd-tolerance assay using the Cd-sensitive *S. cerevisiae* *Ycf1Δ* strain expressing or not the full-length or truncated (N or Cterminal domains) CRP5 sequences. In both tests, the wild-type strain BY4741 was used as a positive metal-tolerant control

Biotechnology

STUDYING THE ROLE OF *rpoN*, THE ALTERNATIVE SIGMA FACTOR, IN THE PATHOGENICITY OF *R. SOLANACEARUM*, THE CAUSAL AGENT OF BACTERIAL WILT IN PLANTS

Project No. 4800-B1

Dec. 2013 to May 2017

Background

Ralstonia solanacearum genome has two genes for the alternative sigma factor, σ^{54} : *rpoN1* (RSc0408) is located in the chromosome and *rpoN2* (RSp1671) is located in the megaplasmid. Initial characterization of these two genes has revealed that *rpoN1* is involved in virulence, twitching motility, nitrate utilization and natural transformation of *R. solanacearum* whereas *rpoN2* is not involved in any of the above properties. Interestingly, *rpoN2* expression is induced in minimal medium as well as in contact with plant cells whereas *rpoN1* expression is constitutive. In addition, *rpoN2* expression is dependent on *rpoN1*. Considering the above observations, the collaborators are interested to use a transcriptomic approach to find out the genes that are under the regulations of *rpoN* genes in this bacterium, some of which appear crucial for virulence and to investigate on different activators that interact with σ^{54} to initiate transcription from σ^{54} specific promoters in *R. solanacearum*.

Objectives

- i) The isolation of a *R. solanacearum* isolate in India phylogenetically related to strain GMI1000 and to establish an infection system on tomato seedlings
- ii) Determination of additional phenotypic traits, to complement the *rpoN1* mutation - instead a second independent mutation in *rpoN1* was genetically characterized

Knowledge Generated / Products Developed

- Characterization of a second loss of function mutation in *rpoN1*
- Phenotypic analysis of *rpoN1* mutants showing that this gene is also required for growth on nitrate (in addition to natural transformation, twitching motility and virulence) but not for swimming motility
- Isolation of a *R. solanacearum* strain (named F1C1) from a wilted chilli plant in India. F1C1 is phylogenetically close to the reference strain GMI1000 and was used to establish an *in vitro* infection assay on tomato seedlings
- Establishment of the transcriptomic profiling of the *rpoN1* and *rpoN2* mutants

Principal Collaborators



Suvendra Kumar Ray
Tezpur University
Tezpur



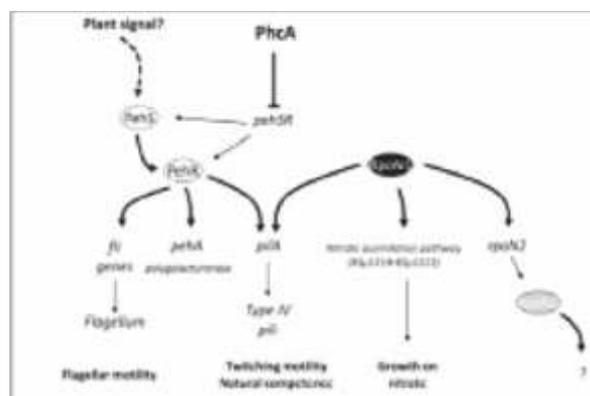
Stéphane Genin
Laboratoire des Interactions Plantes
Micro-organismes (LIPM)
UMR CNRS/2594/INRA 441
Castanet Tolosan

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 1



Model describing connection between RpoN1 and PehR and their role in the control of several *R. solanacearum* virulence determinants

DNA-ENCAPSULATED QUANTUM DOTS FOR BIO-IMAGING

Project No. 4803-2

Feb. 2013 to Sep. 2016

Background

It has proved non-trivial to functionalize quantum dots (QDs) with bioactive molecules such as proteins and nucleic acids due to the incompatibility between QD surface chemistries and bio-functionalization chemistries. It has also proved non-trivial to achieve bio-functionalization with well-defined stoichiometries in bulk. These limitations have severely restricted the applications of QDs for *in cellulo* and *in vivo* imaging. The project is to create and characterize synthetic host-cargo complexes where the host is a polyhedral DNA capsule and the encapsulated cargo is a QD. Encapsulation of the QD inside a synthetic DNA host nullifies the need for bio-functionalisation chemistry and QD surface chemistry compatibility. Furthermore, a DNA host has addressable locations for bio-functionalization and thus stoichiometry of bio-conjugation is exquisitely tunable in bulk. They propose to demonstrate the power of such DNA encapsulated QDs by showcasing their bio-imaging applications in cellulo.

Objectives

1. Prepare DNA-functionalized quantum dots for biological applications
2. Make different types of quantum dots (QD) that are non-blinking
3. Functionalize QDs with known stoichiometry of DNA
4. Use these DNA-QD conjugates for biological applications

Knowledge Generated / Products Developed

- A novel method to conjugate DNA to Quantum dots directly
- Demonstration of general applicability of this method to other biomolecules (DNA, proteins, antibodies, peptides) and different nanoparticles (various types of QDs, gold nanoparticles and other colloidal systems)
- Use of this method to develop novel bioimaging probes with enhanced photostability and biological performance
- A novel method to encapsulate quantum dots in DNA nanocapsules
- Functionalized DNA-QDs with precise stoichiometry of endocytic ligand and used for endocytic tracking in live cells

Principal Collaborators



Praveen Kumar Vermula
National Centre for Biological Sciences
TIFR
Bangalore



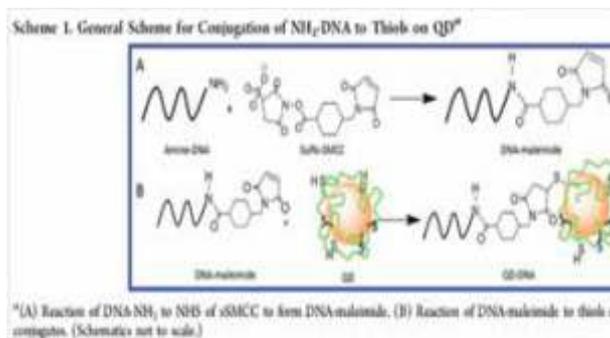
Benoit Dubertret
UMR8213, CNRS-ESPCI Paris Tech
Laboratoire de Physique et d'Etude
des Matériaux
75005 Paris

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 1
- France to India: 1



Materials Science

HIGH ANISOTROPY MOLECULAR MAGNETS: SYNTHESIS AND MODELLING

Project No. 4808-1

Sep. 2012 to Aug. 2016

Background

Rational design and synthesis of single molecule magnets (SMMs) and single chain magnets (SCMs) with large negative magnetic anisotropies and high blocking temperatures is essential to raise the temperatures below which these phenomena are manifest. It was recently demonstrated, by the French investigator, that hepta coordinated transition metal complexes have very high magnetic anisotropies. The design principle involves use of these complexes as well as rare earth magnetic ions as building blocks for the synthesis of SMMs and SCMs with high magnetic anisotropy. Modelling these systems in which the magnetic exchange interaction strengths are comparable to the strength of magnetic anisotropy require new techniques. These have been developed recently by the Indian investigator for solving many-body electronic as well as magnetic models. Theoretical inputs will be provided for the design of SMMs and SCMs as well as to model the systems after they are synthesised and their properties are investigated.

Objectives

- Synthesis of low dimensional (discrete, 1-D) molecular magnets based on complexes with unusual coordination to enhance magnetic anisotropy
- Study of structure-property relations of the so synthesised magnets. Both static and dynamic magnetic properties would be studied, besides other properties such as optical properties, heat capacities and related thermodynamic properties
- Development of theoretical tools to model magnetic systems with strong anisotropy and exchange interactions for systems with assorted spins
- Application of these techniques to model the compounds synthesised by the French group

Knowledge Generated / Products Developed

- Synthesis of heptacoordinated Ni(II) and Fe(II) complexes in D_{5h} surrounding
- Demonstration of their substantial magnetic anisotropy, and effect of ligands on it
- Preparation of heterometallic compounds with these Ni and Fe building units
- Novel hetero-trispin (2p-3d-4f) chain compounds
- Modeling of the magnetic behaviours by novel VB technique

Principal Collaborators



S. Ramasesha
Indian Institute of Science
Bangalore



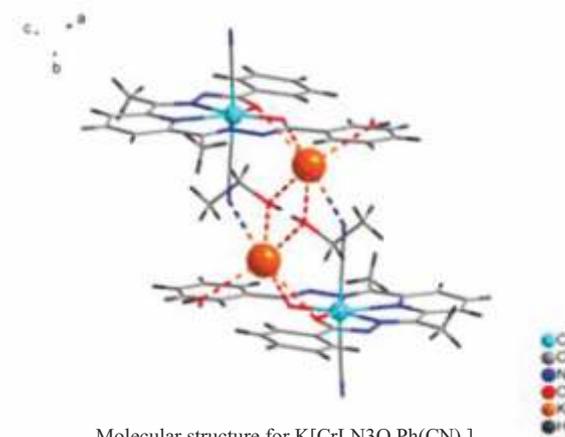
Jean Pascal Sutter
Laboratoire de Chimie de Coordination
du CNRS
Toulouse

Publications

- No. of publications in SCI journals : 23
- No. of papers presented in conferences: 14

Mobility Support

- India to France: 4
- France to India: 3



CONTROL OF MELANOSOME BIOGENESIS BY SMALL GTPases

Project No. 4903-1

Mar. 2013 to Feb. 2017

Background

Skin pigmentation and photoprotection against ionizing radiations requires the synthesis of melanin by melanocytes. Melanin is produced in melanosomes that are transferred to keratinocytes. The previous studies provide a conceptual framework to decipher trafficking pathways that underlie the formation of functional melanosomes. These pathways are altered and/or impaired in melanoma. By using a fruitful combination of light and electron microscopy and biochemistry one challenge of this project is to provide a better understanding on molecular machineries and trafficking steps leading to melanosome biogenesis. The collaborators will focus on Small GTPases of the Rab and Arl families as potential candidates to regulate cell pigmentation. Investigators will decipher the intracellular trafficking steps at which these machineries act and will characterize their effectors. The acquired knowledge will allow identifying potential targets to manipulate pigmentation and will contribute to a better knowledge on alterations in melanoma.

Objectives

- Investigate the role of small GTPases Rab in endosomal trafficking in melanocytes and in the production of functional melanosomes
- Investigate the function of GTPases of the Arl family in the formation of melanosomes
- Investigate how trafficking in melanocytes controlled by these proteins and melanocyte biogenesis/ transfer is influenced by interactions with keratinocytes

Knowledge Generated / Products Developed

- Identified several endosomal Rab GTPases that regulate different protein trafficking steps from different endosomal domains during melanosome biogenesis
- Unraveled a previously unknown post Golgi-melanosome pathway required for melanogenesis and controlled by Rab6AA' GTPases
- Identified an Arf-like GTPase (ARL4A) that regulate melanosome biogenesis by controlling AP-3 dependent cargo transport to melanosomes

Principal Collaborators



Subba Rao Gangi Setty
Indian Institute of Science
Bangalore



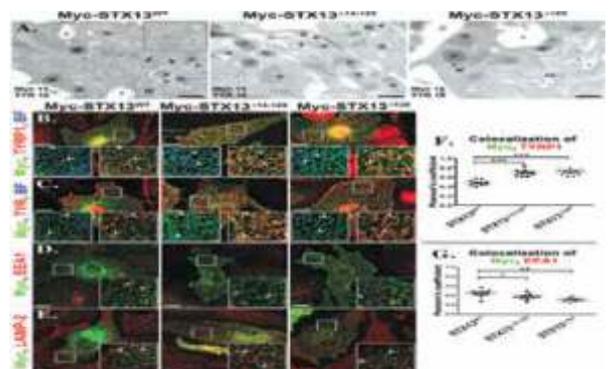
Graça Raposo
Institut Curie
CNRS UMR144
Paris

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 1
- France to India: Nil



Regulatory-domain-deficient STX13 mutants localizes to melanosomes

STUDY OF NEURAL DEVELOPMENT IN hiPS MODELS OF MICROCEPHALY

Project No. 4903-2

Mar. 2013 to Feb. 2017

Background

The aim of this project is to create *in vitro* models of complex human brain disorders. The collaborators chose to focus on microcephaly because animal models are inadequate to understand its pathophysiology. Furthermore, it is a disorder whose etiology begins very early in development in utero long before the phenotypic manifestation can be seen. To create models of human genetic diseases in a humanized context collaborators will make use of the human induced pluripotent stem cell (hiPS) technology. In this the patient's own somatic cells will be taken and converted into embryonic-like stem cells. These hiPS cells will then be converted into neural stem cells and differentiated neurons. This powerful approach would be enabling the collaborators to study the development of neurons of the patient with a genetic mutation that causes mental retardation. Since there are no cures for several complex brain disorders and therefore this approach could prove very valuable in coming up with novel signaling pathways and potential drug targets.

Objectives

- To generate human induced pluripotent stem (hiPS) cell lines from normal human fibroblasts and patients fibroblasts mutated in MCPH1
- To differentiate normal and patient hiPS cell lines into neural progenitors and differentiated cortical neurons
- To study cell cycle and proliferation of neural progenitors from normal and patient hiPS lines
- To study cortical neurons specification (layer markers and connexions)
- To study mode of cell division and centrosome composition in neuronal progenitors derived from hiPS cell lines

Knowledge Generated / Products Developed

- Reprogramming fibroblasts to make iPSCs, and characterizing the iPSCs to confirm they have been fully reprogrammed. Efficient reprogramming was assessed by both immunocytochemistry and real time PCR using a panel of markers. In addition, protocols for consistent generation of forebrain neurons were optimized. From the time of seeding iPSCs to obtaining fully differentiated human forebrain neurons takes about three months
- Reprogrammed iPSCs from an MCPH1 patient in addition to the iPSC we had reprogrammed from a normal control
- Demonstrate that the patient iPSCs are deficient in forming neuronal rosettes. This is the first time that deficient rosette formation for this mutation has been shown and therefore it has important implications for the characterization of the microcephaly phenotype

Principal Collaborators



Shyamala Mani
Indian Institute of Science
Bangalore



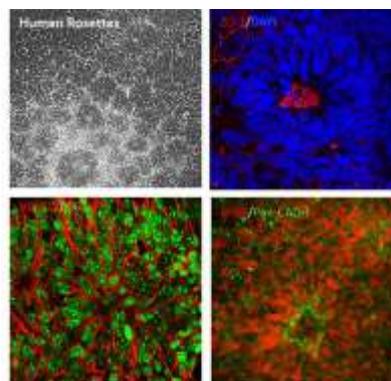
Pierre Gressens
Inserm U 676
Hôpital Robert Debre
Paris

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: 2



Legend for attached picture. Top left – bright field image of a human neural rosette. Top right – organization of the rosette with the apical membrane aligned to the centre of the rosette as marked by ZO-1, an apical marker. Bottom left - Nestin positive cells that are labelled with the proliferation marker Ki67 to show that these are proliferating neural precursors. Bottom right - Pax6 staining to show their forebrain character

GLOBAL TRANSCRIPTOMICS OF SEX-SPECIFIC SPLICING

Project No. 4903-4

May 2013 to Apr. 2017

Background

The LAMMER protein kinase *DOA* regulates the determination of somatic sexual identity in the fruitfly *Drosophila* via the phosphorylation of the SR-like proteins TRA and TRA2 and their induction of alternative splicing of transcripts encoding the binary switch sex determination protein DSX. Global transcriptomic analysis (RNA-Seq) of wild-type and *Doa* mutants recently revealed transcripts which are both sex-specifically spliced in wild-type but also under the control of *DOA*, independently of TRA and TRA2. The collaborators will analyze the role of these sex-specific transcripts in sexual determination in both *Drosophila* (male heterogametic sex) and the silkworm, *Bombyx mori* (female heterogametic sex), to identify loci which play conserved roles in insect sex determination. The data could have important commercial applications in the silkworm and lepidopterans in general, a group including a large number of agricultural pests, for which no clear model of sex-determination exists.

Objectives

- To characterize and compare the sex specific splicing of pre-mRNAs via highthroughput sequencing of cDNAs (RNA-Seq), in two insect species, a male heterogametic system (*Drosophila melanogaster*) and a female heterogametic system (*Bombyx mori*)
- To analyze the novel molecular players involved in sex determination in these two insect model systems

Knowledge Generated / Products Developed

- Completion of analysis of sex and *DOA* mutant-specific RNA-Seq data in *Drosophila*
- Validation of numerous alternative splicing and other events altered by mutation of the *Doa* locus of *Drosophila* via qPCR
- Generated massively parallel RNA-seq data for sex specific early stage embryos in *Bombyxmori*
- Given evidence for the first time for the existence of sex chromosome dosage compensation in *Bombyxmori*
- Demonstration of somatic sex transformations in RNA-binding protein mutants in combination with *Doa* alleles (Taf1, sqd, pUf68)

Principal Collaborators



Arun Kumar
Centre for DNA Fingerprinting & Diagnostics
Hyderabad



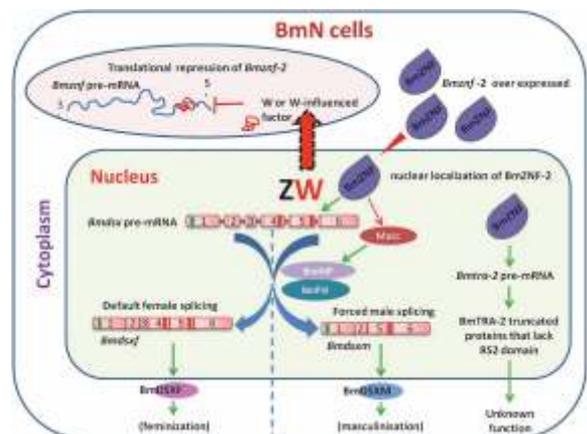
Leonard Rabinow
UMR8195
Université Paris Sud
Orsay

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 1



A model representing the influence of BmZNF-2 protein on splicing of Bmdsx and Bmtra-2 pre-mRNAs

Pure & Applied Physics

REVERSALS OF A LARGE SCALE FIELD ON A TURBULENT BACKGROUND

Project No. 4904-1

Mar. 2013 to Dec. 2016

Background

The recent experimental observations of magnetic fields generated by turbulent flow have prompted new interest in the studies of magnetohydrodynamic (MHD) flows in liquid metals and plasmas. Such flows raise both fundamental problems, as well as find applications in geophysics, astrophysics, and various industrial processes. The collaborators will use numerical simulations and theoretical models to understand experimental results as well as observations related to a striking phenomenon: the dynamics of large scale fields on a turbulent background. This includes random reversals of the field polarity, as observed for the magnetic fields of the Earth or the Sun and for large-scale zonal wind in the Earth's atmosphere. The collaborators will determine why a small number of large-scale modes accurately capture the dynamics of the reversals although these systems are strongly turbulent and will study how reversals are triggered and determine their correlation with the fluctuations of the energy flux that drives the large scale modes.

Objectives

- To study how and why these large scale fields abruptly change their polarity
- To understand why a small number of large scale modes nicely capture the reversal dynamics although these systems are strongly turbulent
- To study the geometry of the reversals, i.e. the modes that are involved in driving the system from one state to the one of opposite polarity, and their relation to the symmetries of the problem
- To identify some of the possible triggering mechanism for the random reversals and study their statistical properties

Knowledge Generated / Products Developed

- Flow reversals and condensate states in Kolmogorov flow in two dimensional geometry. It is observed an excellent agreement between the simulations and experiments
- Numerical study of energy transfers during reversals of the magnetic field. It has been shown that the power of the Lorentz force decreases before reversals
- Flow reversals in free-slip RBC in two dimensions for large Prandtl number convection. The behaviour of no-slip and free-slip RBC are different
- Symmetries of the flow reversals identified as $Z_2 \times Z_2$ group

Principal Collaborators



Mahendra Kumar Verma
Indian Institute of Technology
Kanpur



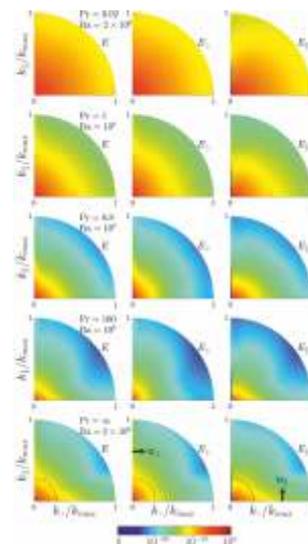
Stephan Fauve
Ecole Normale Supérieure
Laboratoire de Physique Statistique
Paris

Publications

- No. of publications in SCI journals : 7
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 1
- France to India: 1



Ring spectra $E(k, \beta)$, $E_{\perp}(k, \beta)$, and $E_{\parallel}(k, \beta)$ (from left to right) depicted for various Pr and Ra (from top to bottom). The plots show nearly isotropic distribution of energy

Pure & Applied Physics

STUDIES OF SPIN LADDER AND HEAVY FERMION SYSTEMS IN EXTREME CONDITIONS OF HYDROSTATIC OR UNIAXIAL PRESSURE AND LOW TEMPERATURE

Project No. 4904-2

Apr. 2013 to Dec. 2016

Background

Discovering and understanding the new states of matter found in the rich phase diagrams and competing ground states of strongly correlated electron systems represent some of the most challenging questions in condensed matter physics today, which even extend to some of the applications of tomorrow. Research in this field relies strongly on the use of high pressure to explore the complex landscape of phenomena but also to manipulate the delicate balance between the various phases. This project aims to harness the complementary expertise of the groups to tackle these questions in Spin Ladder systems where the low dimensionality of the magnetic correlations is fundamental, and Heavy Fermion systems, where the electronic interactions create a strong renormalisation of the energy scales.

Objectives

- To gain further understanding of the physics of the novel and competing orders that exist in two different families, namely spin ladder and heavy fermion systems
- To grow single crystals of $Sr_3Fe_2O_7$ and other spin ladder systems using floating zone furnace
- To grow single crystals of heavy fermion compounds with emphasis on anisotropic systems where the comparison of hydrostatic and uniaxial pressure is particularly interesting
- To setup thermal expansion measurements in Grenoble at zero pressure using a capacitive technique
- To design and fabricate using expertise from Grenoble the Diamond Anvil Cell for electrical resistivity and magnetization measurements suitable for PPMS and VSM respectively and to carry out research in CHPR
- To characterize the single crystals using powder and Laue diffraction, TEM, SEM, electrical
- To investigate electrical resistivity and magnetization measurements under uniaxial pressure at low temperature and high magnetic field
- To develop phase diagrams using uniaxial pressure, hydrostatic and quasi-hydrostatic method using corresponding pressure cells

Knowledge Generated / Products Developed

- Synthesis, characterization and magnetization under hydrostatic and uniaxial pressure of $YbNi_3Al_5$ single crystals. Magnetic properties of $CeRu_2Sn_6$ Alloy under hydrostatic pressure upto 1 GPa. Electrical resistivity measurements of topological insulator $CuIr_2S_4$ up under pressure up to 8GPa
- Synthesis, characterization, and orientation of spin ladder $Sr_3Fe_2O_{6.75}$, $La_5Ca_9Cu_{24}O_{41}$, $CaCu_2O_3$ crystals
- Structure, magnetic properties and magnetocaloric effect in $LaMnSbO_{0.8}F_{0.2}$ oxypnictide material and effect of hydrostatic pressure on the magnetic and superconducting transitions of $GdFe_{1-x}Co_xAsO$ ($x=0, 0.1 \& 1$) compounds
- Design and fabrication of DAC is completed in CEA and integrating with PPMS is under progress
- Design and fabrication of pressure cell for magnetization measurements under pressure is completed

Principal Collaborators



S. Arumugam
Bharathidasan University
Tiruchirappalli



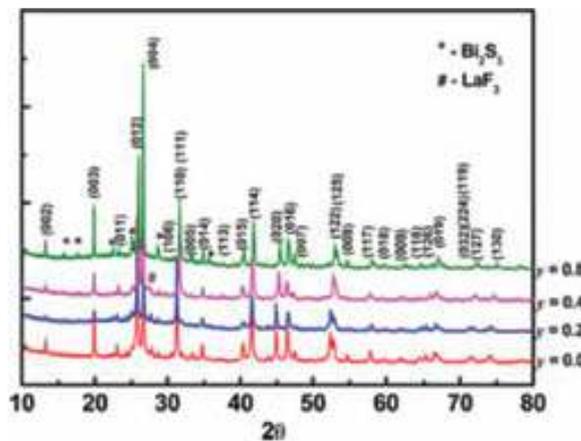
Daniel Braithwaite
Institut Nanosciences et Cryogénie
INAC/SPSMS/IMAPEC, CEA Grenoble

Publications

- No. of publications in SCI journals : 11
- No. of papers presented in conferences: 5

Mobility Support

- India to France: 2
- France to India: 2



Powder X-ray diffraction patterns for $La_{1-y}Sm_xO_{0.5}F_{0.5}BiS_2$

Pure & Applied Chemistry

KINETICS AND SPECTROSCOPY IN EXTREME ENVIRONMENTS:
APPLICATIONS TO ASTROPHYSICS AND ASTROCHEMISTRY

Project No. 4905-1

Mar. 2013 to Aug. 2016

Background

The aim of the project is centred on the acquisition of some fundamental data relevant to Astrophysics and Astrochemistry. During collaborators previous project, a novel high temperature source was designed and developed. This could be used for spectroscopic and kinetics studies at high temperatures, typically in the range of 800 – 2000 K. In the current project, the collaborators would like to use this source for production of materials (simulating hot astrophysical atmospheres) and kinetics and spectroscopic studies at high temperatures. In parallel, the existing facilities at Rennes and Bangalore will be used to complement these experiments. In particular, shock tube studies on propargyl alcohol pyrolysis and combustion, C atom reactions with small hydrocarbons, FTMW investigations propargyl alcohol and its complexes will be carried out in Bangalore.

Objectives

- Shock tube experiments coupled with ex situ characterization of gases and carbon particles
- Microwave spectroscopic investigations on molecular complexes including propargyl alcohol complexes towards understanding intermolecular interactions
- Development of a new High Enthalpy Source for Cavity Ring-down Spectroscopy in hypersonic flows
- Catalytic effect of substituted methane molecules on water nucleation
- Development of a new flow reactor for high temperature kinetics studies

Knowledge Generated / Products Developed

- The studies on shock-wave processing of C_{60} in hydrogen confirmed the role played by the C_2 radical as a major product of C_{60} fragmentation and less expectedly highlighted the existence of a single C atom loss channel
- Microwave spectrum of propargyl alcohol and hexafluoroisopropanol complexes were solved which helped in improving our understanding of intermolecular bonding
- Based on microwave spectroscopy results on argon-propargyl alcohol complex, a carbon bond was proposed in Bangalore and a joint proposal to SOLEIL was submitted to investigate H_2O-CH_3F complex. This led to the observation of a new catalytic effect of substituted methane molecules (CH_3F and CH_3Cl) on the nucleation of water
- A new experimental set-up has been developed, aided by modeling studies, to probe hypersonic flows using the ultra-sensitive Cavity Ring-down Spectroscopy technique
- The emission infrared spectroscopic data have been used to model the spectrum of methane at high temperature in the 7.7 micron range

Principal Collaborators



Elangannan Arunan
Indian Institute & Science
Bangalore



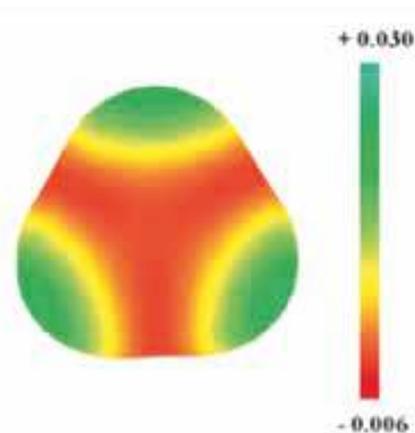
Robert Georges
Institut de Physique de Rennes
CNRS-Universite, de Rennes 1
Rennes

Publications

- No. of publications in SCI journals : 13
- No. of papers presented in conferences: Several

Mobility Support

- India to France: 4
- France to India: 3



Molecular electrostatic potential for methane molecule. Relative color code bar is shown on right

Earth & Planetary Science

TROPICAL CYCLONES IN THE BAY OF BENGAL: OCEANIC RESPONSE AND AIR-SEA INTERACTIONS

Project No. 4907-1

Apr. 2013 to Jun. 2016

Background

The aim of the project is for a better understanding of the ocean response and air-sea coupling under tropical cyclones (TCs) in the Bay of Bengal. TCs intense winds drive strong vertical mixing, leading to surface cooling and chlorophyll blooms. The cooling can inhibit the TC intensification, while the chlorophyll bloom may lead to enhanced fish catches. The Bay of Bengal is unique amongst TCs prone regions, for its very strong salinity stratification related to the large fresh water input during the monsoon. This salinity stratification inhibits mixing, and could hence limit the ocean ability to negatively feedback on the cyclone intensity. To better quantify the influence of salinity stratification on the amplitude of TC-induced chlorophyll blooms and surface cooling, using an ocean model. Finally, the collaborators will quantify the skill improvement brought by accounting for air-sea interactions under TCs by developing a TCs statistical prediction models in the Bay of Bengal.

Objectives

- Quantify the oceanic control on tropical cyclones-induced surface temperature response in the Bay of Bengal, with an emphasis on the role of salinity stratification on the amplitude of TCs-induced chlorophyll blooms and surface cooling using a forced ocean model
- Understand how this surface cooling retroacts onto the TC characteristics in this region by using a regional coupled ocean-atmosphere model
- Develop statistical prediction schemes in this region in order to quantify the skill improvement brought by accounting for ocean-atmosphere interactions under TCs

Knowledge Generated / Products Developed

- Quantification of the impact of salinity stratification on TCs induced cooling
- Quantification of TCs contribution to chlorophyll and primary production
- Quantification of the impact of airsea coupling on TC characteristic
- Setup of consistent statistical scheme for TCs intensity forecast at global scale
- Improvement of TCs intensity statistical scheme by using a non-linear scheme and including oceanic parameters

Principal Collaborators



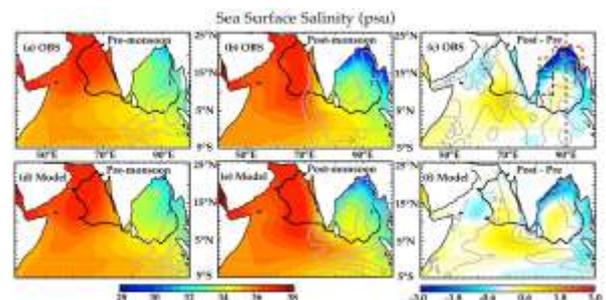
S. Neetu

CSIR-National Institute of Oceanography
Goa



Matthieu Lengaigne

LOCEAN, IRD/CNRS/UPMC/MNH
Paris



Climatological SSS (in psu; color) and BLT (in meters, grey contours) for pre-monsoon (left panels) and post-monsoon (middle panels) seasons and their difference (right panels) derived from observed SSS climatology and BLT climatology (upper panels) and model (lower panels). The thick contour delineates the region where 80% of TCs occur in the northern Indian Ocean (i.e., where TCs density is larger than 0.4 TCs per year in 2° by 2° bins)

Publications

- No. of publications in SCI journals : 3
- No. of papers presented in conferences: 7

Mobility Support

- India to France: 4
- France to India: 4

Pure and Applied Mathematics

HYPERGEOMETRIC FUNCTIONS: HARMONIC ANALYSIS AND REPRESENTATION THEORY

Project No. 5001-1

Mar. 2014 to Feb. 2017

Background

The hypergeometric functions associated with root systems are representation-theoretical motivated multivariate hypergeometric functions. They originated in the work of Heckman and Opdam (with further contributions by Cherednik) and may be seen as a natural extension of the spherical functions, due to Harish-Chandra, for semisimple Lie groups and Riemannian symmetric spaces. The study of hypergeometric functions associated to root systems is nowadays a central theme in many areas of mathematics, such as harmonic analysis, representation theory, combinatorics and probability. For instance, several combinatorial conjectures due to Macdonald were settled with the help of this theory.

Objectives

- To develop the Heckman-Opdam theory of hypergeometric functions in several directions
- To develop a similar theory for root systems of Lie superalgebras and supersymmetric spaces

Knowledge Generated / Products Developed

Developed Heckman-Opdam-Cherednik theory on root systems of type BC_n as a generalization of the harmonic analysis on homogenous line bundles over a non-compact Hermitian symmetric space G/K associated to one dimensional representations of K . The corresponding spherical functions are related to the hypergeometric functions of Heckman-Opdam, but with non-positive multiplicity functions which are one-parameter deformations of positive ones. For certain specific values of these deformations, It was proved that the new Heckman-Opdam hypergeometric functions are positive when the rank is one and the spectral parameter is real. The proof uses as a main tool some classical formulas for the one-variable hypergeometric functions. For the general case, even in the rank one case, it is then clear that new ideas are required

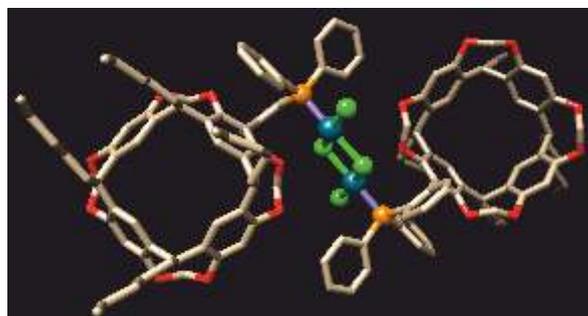
Principal Collaborators



E. K. Narayanan
Indian Institute of Science
Bangalore



Angela Pasquale
Laboratoire de Mathématiques et Applications
de Metz
(UMR CNRS 7122)
Université de Lorraine – Metz



Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 3
- France to India: 2

Molecular structure of centrosymmetric 9. Biaryl dihedral angle in the cavitand subunits: 78.9°. Separation between the centroids of distal aromatic rings in each cavitand: 6.58 and 6.63 Å. Important bond lengths (Å) and angles (°): Pd-μ-Cl 2.3462(7) and 2.3951(7), Pd-Cl 2.2827(8), Pd-P 2.2421(7), Pd-μ-Cl-Pd 95.68(2), μ-Cl-Pd-Cl 90.78(3), Cl-Pd-P 91.29(3), P-Pd-μ-Cl 93.14(3), μ-Cl-Pd-μ-Cl 84.31(2)

MUSCLE SC SELF-RENEWAL: A STRESSFUL MATTER?

Project No. 5003-1

Jan. 2014 to Jan. 2017

Background

Selenoprotein N (SelN) is the only selenoprotein linked to a monogenic disease, SEPNI-related myopathy, presenting with severe muscle weakness and wasting. Increase of intracellular oxidant activity in the absence of SelN suggests an antioxidant role, but SelN interactions and functions are poorly understood. Loss of muscle stem cells (satellite cells; SC) and regenerative capacity in SelN KO mice has recently revealed SelN as a novel key actor in maintaining muscle stemness. Using a combination of *in vitro* and *ex vivo* expertise and models, the Project will clarify the role of SelN, associated oxidative stress and epigenetic modifications in SC self-renewal, and their response to pharmacological intervention. This will help to understand better the mechanisms determining muscle stemness and their therapeutic applications in regenerative medicine.

Objectives

- To delineate the role of SelN as a novel key actor in the molecular control of self-renewal, activation or differentiation in muscle progenitors using *ex vivo* and *in vitro* strategies
- To define the link between SelN, oxidative stress and epigenetic regulation of muscle progenitor cell fate

Knowledge Generated / Products Developed

- Assayed the ability of cells lacking SelN to be quiescent
- Examined the activation potential of primary cells from the SelN knockout mouse
- Over-expressed truncation mutations of SelN cDNA in culture to examine the effects of the individual domains on proliferation, quiescence and differentiation
- Expressed and purified an active SelN fragment in order to determine its interactome using mass-spectrometry

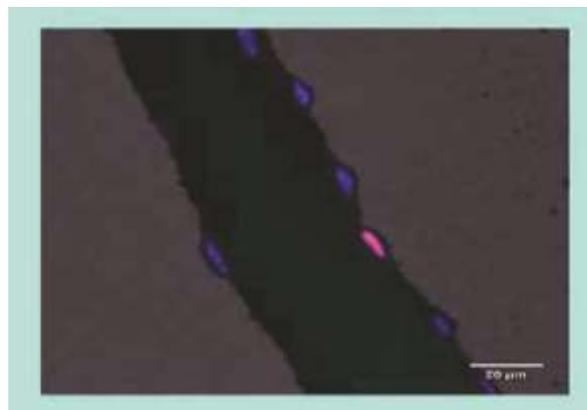
Principal Collaborators



Jyotsna Dhawan
Institute for Stem Cell Biology and
Regenerative Medicine, NCBS
Bangalore



Ana FERREIRO
INSERM Université de Diderot-CNRS
Paris



A muscle fibre with satellite cells

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: Nil

Pure & Applied Physics

ADVANCED COMPUTATIONAL MODELS TO FACILITATE SOLAR ACTIVITY AND SPACE WEATHER PREDICTIONS

Project No. 5004-1

Jan. 2015 to Dec. 2017

Background

The Sun's activity varies primarily due to its magnetism. Solar variability modulates the near-Earth Space environment and creates what is known as space weather. Space weather is hazardous to satellite operations, telecommunications and air-traffic on polar routes. Slow-long term solar activity variation also influences the global climate. Studies of the Sun-Earth-System is now a rapidly emerging multidisciplinary science, in which, a fundamental challenge is in understanding the origin of solar magnetic fields and forecasting it. Taking advantage of complementary expertise of the Indian and French PI's, collaborators propose to develop global, coupled computer models of magnetic field generation and dynamics from the solar interior to its surface and further intend to implement sequential observational data assimilation in this solar model to develop it towards realistic predictions of future solar activity, whose knowledge is essential for mitigating the impacts of space weather.

Objectives

- Understand how the decay and dispersal of the magnetic fields of bipolar sunspotpairs - mediated via observed solar surface flows – generate the solar dipolar field
- Using the experiences gained from the earlier approach construct a global, 3-D kinematic solar dynamo model which is coupled to a 3-D MHD magnetic flux tubedynamics model in the SCZ.
- Develop techniques for observational data assimilation in the 3-D global solar dynamo model to move towards data driven forecasts of future solar magnetic activity

Knowledge Generated / Products Developed

- Development of the solar surface magnetic flux transport model has been developed
- Data assimilation techniques have been perfected and last 100 year data is being used as sequential inputs to the solar surface flux transport code for the longest ever continuous simulation of solar activity
- A comprehensive report on computational modelling of solar stellar magnetic fields and connection has been published

Principal Collaborators



Dibyendu Nandi
Indian Institute of Science
Education and Research
Kolkata



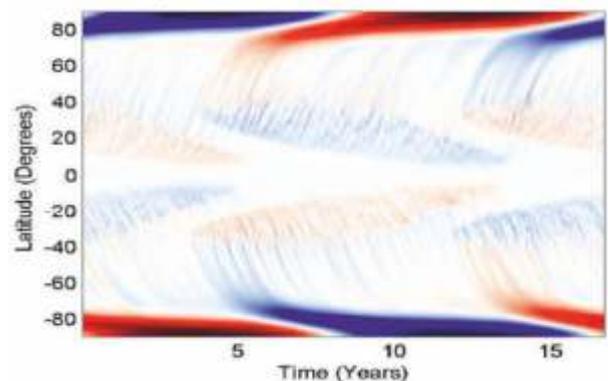
Laurène Jouve
Institut de Recherche en Astrophysique et
Planétologie, Université Paul Sabatier
Toulouse

Publications

- No. of publications in SCI journals : 1
- No. of papers presented in conferences: 1

Mobility Support

- India to France: Nil
- France to India: Nil



A theoretical diagram stimulated using 2D kinematic solar dynamo model

Pure & Applied Chemistry

INFLUENCE OF THE RESORCIN[4]ARENE ON THE CATALYTIC OUTCOMES

Project No. 5005-1

Dec. 2013 to May 2017

Background

The Project aims at producing catalytic reactions taking place inside a molecular cavity. Four types of ligands based on the resorcin[4]arene platform will be considered, all having either pyridine moieties or phosphorus atoms connected to the larger rim of a conical resorcinarene backbone. The presence of a cavity able to host a catalytic centre is mainly expected to favour substrate or product discrimination. Moreover, the confinement of the catalytic center should introduce a high regioselectivity of the formed products. The resorcinarenyl-complexes will be assessed in carbon-carbon bond forming reactions, hydride transfer and addition of TMSCN to aldehyde. Recycling of the catalysts will be also studied, notably by preparing polymeric derivatives. The present research is a fundamental contribution to the discovery of homogeneous catalysts operating in a confined environment.

Objectives

- The development of pyridyl-resorcinarene derivatives for substrate and product selectivity in cross-coupling reactions
- The synthesis of capped resorcinarenes for function discrimination especially for carbonyl groups discrimination in hydrogen transfer or addition of TMSCN
- The generation of metallo-capsules able to induce shape selectivity in transition metalcatalysed reactions
- The development of asymmetric phosphoramidites based on a resorcin[4]arene platform and their catalytic applications

Knowledge Generated / Products Developed

- Phosphinated and nitrogenated resorcin were synthesised. Catalytic applications of these cavitands are undergoing.
- Generation of new knowledge in the areas of the synthesis of phosphinated and nitrogenated resorcin[4] arenes
- Succeeded to prepare chiral phosphites built on a resorcinarene platform, coordination and catalytic studies are undergoing

Principal Collaborators



Rengan Ramesh
Bharathidasan University
Tiruchirappalli



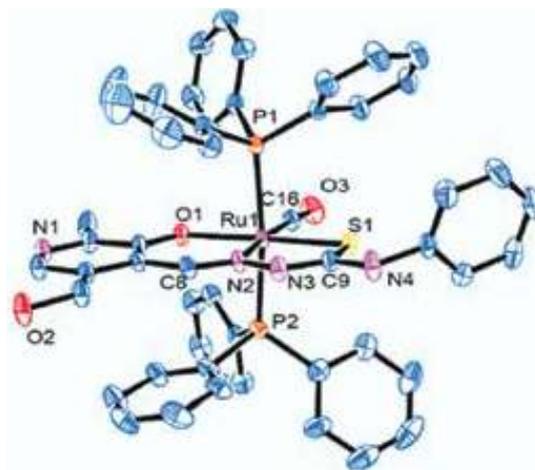
David Semeril
LCMC,UMN-CNRS 7177
Université de Strasbourg
Strasbourg

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 3
- France to India: 3



Molecular structure of (1) showing the 30% probability level and the solvent

Pure & Applied Chemistry

DESIGN AND SYNTHESIS OF NEW C₁-SYMMETRIC BIARYL-BASED LIGANDS AND CATALYSTS AND THEIR EVALUATION IN ASYMMETRIC CATALYTIC REACTIONS

Project No. 5005-2

Dec. 2013 to Jun. 2017

Background

The aim of the Project is to design and develop new classes of C₁ symmetric ligands or organocatalysts based on a biaryl backbone and to evaluate their catalytic efficiency for various catalytic reactions. To begin with ortho, ortho'-dibromobiaryls, ligands will be synthesized and further attempts will be made for the atropodiastereoselective functionalization towards enantiopure ligands. It is planned to synthesize C₁-symmetric ligands such as O,O-, N,N-, or P,N- ligands as well as phosphate and phosphoramidite ligands. The compounds prepared in this way with or without metal complex will be screened for their catalytic activities and enantioselectivities. The catalytic reactions to be studied involve asymmetric aldol reaction, multicomponent C-C bond forming reaction, asymmetric conjugate addition, asymmetric hydrogenation and hydroboration, propargylation and Petasis reactions.

Objectives

The primary objective of the project is to design and develop new classes of C₁ symmetric ligands based on a biaryl backbone and to evaluate their catalytic efficiency for various catalytic reactions. Based on the know-how developed by the French Partner, new biaryl based ligand families will be prepared:

- Synthesis of new classes of C₁-symmetric ligands or organocatalysts based on a biaryl backbone
- Screening of the catalysts for their catalytic activities and asymmetric inductions. Based on the know-how in asymmetric reactions of the Indian Partner, the following reactions are planned using the above ligands

Knowledge Generated / Products Developed

- The C₁ Symmetric biaryl-based phosphine catalysts with different substituents were prepared
- Pd-catalyzed C-N cross-coupling reactions were chosen as model reaction to screen the catalyst. The results showed that steric bulk and the electronic properties of substituents on phosphorous atom play a crucial role in governing the catalytic activity of C-N cross coupling reactions
- The Pd-catalyzed reaction was found to be general as it works for coupling of a variety of aryl halides with both primary and secondary amines
- The reaction requires longer time under reflux conditions while the same reaction under microwave irradiation is completed within 5-10 minutes. This is significant advancement over the reported methods

Principal Collaborators



Pradeep Kumar
National Chemical Laboratory
Pune



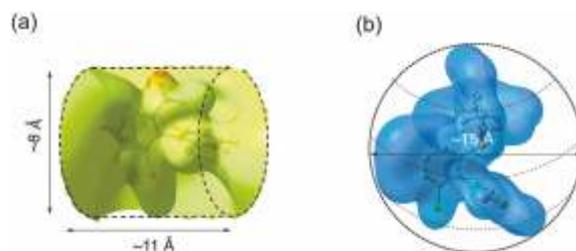
Frédéric Leroux
Laboratoire de Chimie Moléculaire
UMR CNRS 7509, COHA-lab
Université de Strasbourg
Strasbourg

Publications

- No. of publications in SCI journals : 2
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 2



Two examples of electrostatic potential (ESP) surfaces (by plotting only their positive contribution and restraining the contour level with isovalues of 0.005 a.u. for both cases) associated to (a) 3 and (b) 12.

CENOZOIC DENUDATION OF SOUTH INDIA

Project No. 5007-1

Jan. 2013 to Nov. 2016

Background

The aim of the project is to evaluate the relative influence of epeirogeny and long-term climate change on the denudation and maintenance of the high elevation escarpment of the passive continental margin of Peninsular India (Western Ghats) over the last 60 Ma. An integrated approach is proposed for detecting and dating erosional paleolandsurfaces and quantifying the chemical and mechanical surface mass transfers linked to the topographic evolution of the continental margin. The main tasks will include (1) mapping of relict paleolandsurfaces, and (2) geochemical, mineralogical and $^{39}\text{Ar}/^{40}\text{Ar}$ geochronological analyses of the laterites carried by these paleosurfaces. Ultimately, one will test the influence of the quantified mass transfers on the vertical lithospheric movements.

Objectives

- Map the relict paleosurfaces bearing bauxites, ferricretes and Mn ore deposits across the WGE, i.e., from the lowland (coastal) to the highland area
- Characterize the lateritic materials (i.e., autochthonous vs. allochthonous) and the underlying geochemical processes for each paleosurface to define the main morpholateritic groups
- Analyze and date by $^{39}\text{Ar}/^{40}\text{Ar}$ radiometry the K-Mn oxides (cryptomelane) sampled at various depths in supergene Mn-ore deposits beneath the paleosurfaces of each group
- Undertake a paleomagnetic study of Fe-oxyhydroxides' mineralization as a complementary dating Method
- Quantify the Cenozoic denudation using the incision and ages of paleosurface groups

Knowledge Generated / Products Developed

The multidisciplinary research ($^{40}\text{Ar}/^{39}\text{Ar}$ dating of K-Mn oxides and topographic analysis) on the western Ghats is an innovative approach that allows to evaluate the post-rift history of high elevation passive continental margins particularly source-to-sink systems in deciphering topographic evolution of divergent margins over geological times scale, mainly Cenozoic, i.e., since the Deccan traps event in Peninsular India. The results have important implications on the interplay of climate and epeirogeny, the weathering and erosion history, and the development of drainage patterns in southern peninsular India over the last 60 Ma

Principal Collaborators



M. Jayananda
University of Hyderabad
Hyderabad



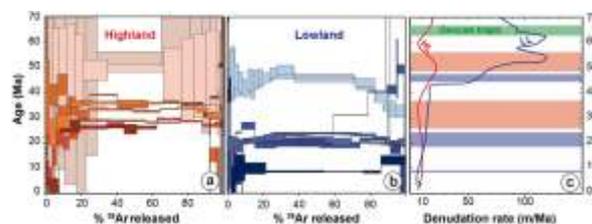
Anicet Beauvais
IRD, CEREGE
Technopôle de l'Arbois
Aix en Provence

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 1
- France to India: 4



A: Stacked $^{40}\text{Ar}/^{39}\text{Ar}$ age spectra of supergene K-Mn oxides from the highland manganese ore occurrences. B: Spectra from the lowland manganese ore occurrences. C: Weathering periods derived from series of $^{40}\text{Ar}/^{39}\text{Ar}$ plateau ages including errors (s), with denudation rate curves derived from inversion model of apatite fission track data, both for the highland (HL) and lowland (LL). (From Beauvais et al., *Geology*, March 2016)

Computational Science

MONTE CARLO AND LEARNING SCHEMES FOR NETWORK ANALYTICS

Project No. 5100-IT-1

Mar. 2014 to Feb. 2017

Background

The aim of the project is to approach various computation problems in network analytics by means of Markov Chain Monte Carlo (MCMC) and related simulation techniques as well as machine learning algorithms such as reinforcement learning, ant colony optimisation, etc. This will include network diagnostics such as ranking, centrality measures, computation on networks using local message passing algorithms, resource allocation issues pertaining to networks and network-based systems such as the internet, peer-to-peer networks, social networks. The work will involve both development of analytical tools and extensive validation thereof using simulation studies. The research will draw upon techniques from graph theory, probability, optimisation, and distributed computation.

Objectives

- Efficient computational methods for centrality measures. This encompasses fast algorithms for estimating between-ness centrality, spectral measures for ranking motivated by dynamic phenomena concerning evolving networks or dynamic phenomena on static networks (such as computation on networks). This will combine techniques from computational linear algebra, MCMC and quasi-MCMC, learning algorithms, in particular reinforcement learning algorithms;
- Decentralised algorithms on networks. This encompasses decentralised search (for e.g., an address, a piece of data, or information) based on random walks for realistic network models, decentralised or distributed computing of spectral ranking measures, multiarmed bandit-based online learning algorithms and/or ant-colony optimisation algorithms for learning routes, decentralised computing of localised centrality measures based on quasi-invariance and metastability

Knowledge Generated / Products Developed

- Whittle index based policies for crawling ephemeral content in web search engines was developed and analysed
- MCMC based algorithm for estimating edge conductance was developed with potential application to graph compression
- Decentralised stochastic approximation algorithm for semi-supervised learning on graphs was developed, analysed and tested
- Theoretical analysis of metastability in replicator dynamics with noise on complex networks was done and tested with Monte Carlo based approach
- Rumour source detection algorithm in absence of temporal information and partial precedence information was developed based on MCMC and tested

Principal Collaborators



Vivek S. Borkar
Indian Institute of Technology Bombay
Mumbai



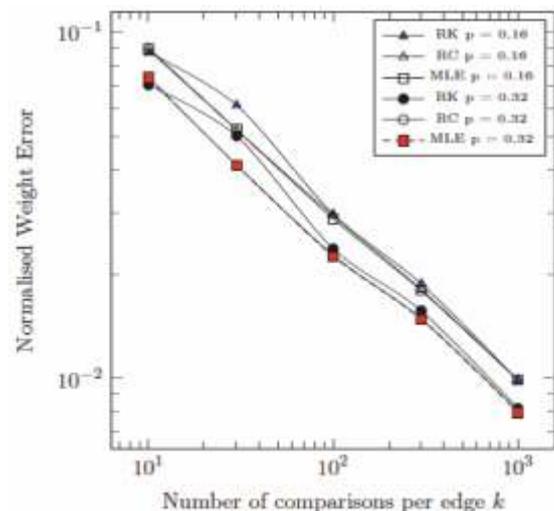
Konstantin Avrachenkov
INRIA Sophia Antipolis
Sophia Antipolis

Publications

- No. of publications in SCI journals : 10
- No. of papers presented in conferences: 7

Mobility Support

- India to France: 3
- France to India: 2



Computational Science

eSYNAPSE BASED ON HETEROSTRUCTURES OF BINARY OXIDES

Project No. 5102-1

May 2014 to Apr. 2016

Background

The aim of the project is to develop electronic nanodevices that mimic the conductivity properties of biological synapses at the size and energy scale of biology. The effective conductance of biological synapses is determined by the time of arrival of pulses at its input and output terminals. Such a device can be developed based on memristive devices that can be programmed to multiple stable resistive states. They will use single or multilayers of binary oxides such as HfOx and TiOx to design memristors and work on the engineering of the oxygen vacancies together with the nature of the top electrode to control ionic motions and filamentary path formation. After full physical and electrical characterization of the devices, timing dependent learning behaviour will be implemented.

Objectives

The goal of the project is to develop electronic nanodevices that mimic the conductivity properties of biological synapses at the size and energy scale of biology. The effective conductance of biological synapses is determined by the time of arrival of pulses at its input and output terminals. To achieve this, it is first necessary to engineer new memristive devices that can be programmed to multiple stable resistive states at switching voltages below 0.5V.

It was proposed to explore HfO₂-based heterostructures grown by different techniques (ALD, CVD and MBE).

Knowledge Generated / Products Developed

- Developed pad probable memristive devices made of Cu/SiO₂/W material stack
- Memristive switching is observed below 0.3V and 100uA switching current
- The fabricated device exhibits half-integer quantum conductance states
- Quantized behaviour can be explained based on subband transport in Cu nano-filaments formed within the SiO₂ dielectric
- Developed HfO₂-CVD/ALD/MBE growth and developed pad probable memristive devices made of TiN/HfO₂/TiN material stack

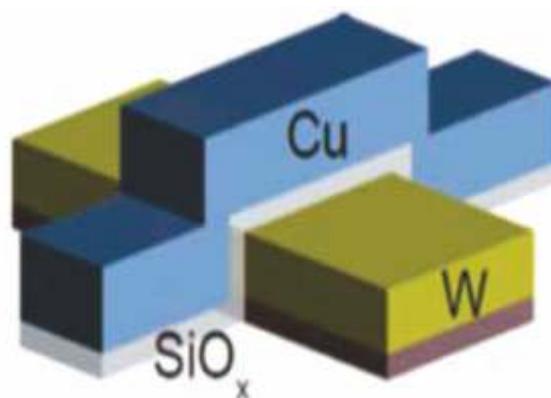
Principal Collaborators



Udayan Ganguly
Indian Institute of Technology Bombay
Mumbai



Catherine Dubourdieu
Institut des Nanotechnologies de Lyon
CNRS – Ecole Centrale de Lyon
Ecully



Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: 2

Normalized Weight Errors in Randomized Kaczmarz (RK), Rank Centrality (RC) and Maximum Likelihood Estimator (MLE) for various number of comparisons per edge k for a constant edge probability $p \in \{0.16, 0.32\}$

Life & Health Sciences

THE IMMUNO-PSYCHIATRY IN SOUTH INDIA STUDY: IMMUNOGENETIC AND IMMUNO-PHENOTYPE CHARACTERIZATION OF MAJOR PSYCHOSES

Project No. 5103-1

May 2014 to Apr. 2018

Background

The objective of the present project is to characterize the nature and extent of dysimmunity associated with schizophrenia and bipolar disorders in two geographically distinct population groups (French Caucasians and South Indians) encountering distinct environmental factors which will provide insights into the genetic and biological heterogeneity of these disorders within and across the studied population-groups. Immunogenetic basis of associated auto-immunity environmental influences on Human Endogenous Retroviruses-W family in establishing the disease and in relapsing the episodes. The expected outcome of this study is the generation of novel biomarkers that could assist in diagnosis, prognosis and in designing novel therapeutic approaches.

Objectives

- To determine the influence of genetic polymorphisms in the MHC gene cluster on disease susceptibility/resistance to schizophrenia and bipolar disorder
- To characterize the immune-phenotype of schizophrenia and bipolar disorder by profiling serum inflammatory proteins, autoantibodies, cytokines and by profiling circulating lymphocyte subpopulations
- To study the influence of ‘W’ family of Human Endogenous Retroviruses (HERV-W) in schizophrenia and bipolar disorder to stratify and analyze the clinical phenotype of patients based on their HERV-W status
- To determine the role of infectious cofactors (potential triggers of the HERV-W) on disease etiology, expression and response to treatment
- To study the innate immune related Toll like Receptor (TLR) gene polymorphisms in Schizophrenia and Bipolar Disorder and their influence on disease susceptibility and outcome

Knowledge Generated / Products Developed

- Class II HLA DR DQ Typing has been carried out for 145 patients (85 SZ, 60 BD) and 20 Super Normal Controls and 148 patients (90 SZ, 58 BD) and 18 Super Normal Controls respectively
- Three SNPs in the non-classical HLA-G and 2 polymorphisms in the HLA-E genes have been profiled in 219 patients (136 SZ and 83 BD) and 110 Super Normal Controls
- Revealed significant trends towards associations with HLA-G SNPs and significantly increased sHLA-G levels in BD
- Study of Antinuclear antibodies (ANA) has been carried out in 270 cases and 131 controls. Further, other antibodies are also being characterized
- Polyclonal IgG antibodies were purified from Schizophrenia (n=18) and Bipolar Disorder (n=11) using CIM-Histidine chromatography and examined for catalytic functions, if any, to understand autoimmunity pattern

Principal Collaborators



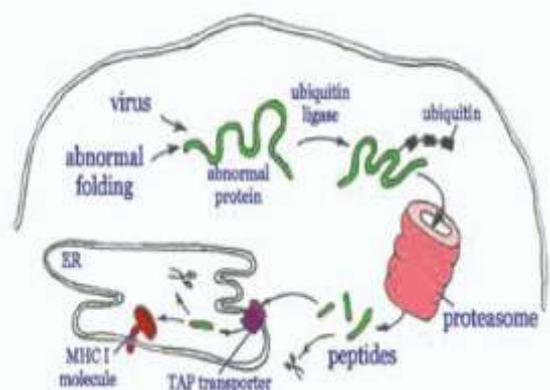
Vir Singh Negi

Jawaharlal Institute of Postgraduate Medical Education and Research Puducherry



Ryad Tamouza

INSERM U1160, Saint Louis Hospital Paris-Diderot (P7) Universit'e de Paris Paris



Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: Nil

OLFACTORY MODULATION OF INSECT FLIGHT

Project No. 5103-2

Apr. 2014 to Apr. 2018

Background

Most insects use odorant cues to orient and fly to food sources and conspecifics: this allows them to increase their dispersion and disseminate vegetal material. However, the neural mechanisms underlying chemo-orientated behaviour remain poorly understood. The collaborators propose to draw the anatomo-functional map of the neural circuitry involved in the olfactory modulation of chemo-oriented walking and flight behaviours in the model species *Drosophila melanogaster*. Using available and newly designed tools and methods, they will take advantage of the complementary expertise of the four teams to: (a) characterize the developing pattern of the neural structures connecting wing chemosensory afferents and central motor neurons, (b) manipulate the peripheral and central structures involved in olfactory-modulated flight, and (c) measure the influence of these neural structures on various aspects of chemo-oriented behaviours and free flight.

Objectives

- Map the developmental pattern of neural structures underlying motor aspects of walking and flying
- Establish the adult pattern of the central neural region(s) receiving the wing chemosensory modulatory inputs and their connection
- Manipulate these neural regions to evaluate their influence on walking orientation and on tethered and free flight in response to odorant cues. For free flight, we will measure (i) take-off, (ii) maintenance, (iii) directionality, and (iv) landing on/near a specific odorant source
- Manipulate the antennal and wing sensory systems to evaluate their respective contributions to each behavior

Knowledge Generated / Products Developed

The use of an automated system for tracking odor-driven free flight of insects has been developed. The use of this automated system has identified several novel features of insect flight:

- Role of wing chemosensors during free flight odor tracking
- Role of pheromonal-related tissues, both neuronal and non-neuronal, in free flight orientation
- Role of central dopaminergic neurons and their activation by octopamine for sustaining flight bout durations

Principal Collaborators



Gaiti Hasan
Tata Institute of Fundamental Research
Bangalore



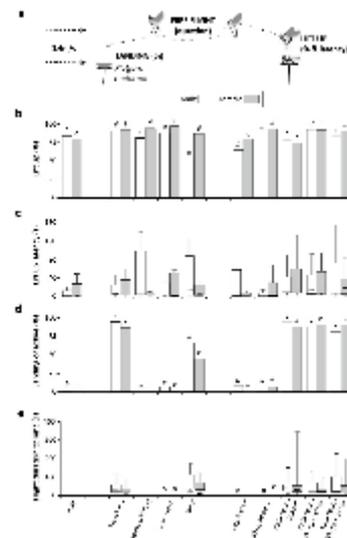
Jean-François Ferveur
Centre des Sciences du Goût et de
l'Alimentation (CSGA)
Dijon

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 3

Mobility Support

- India to France: 4
- France to India: 4



Free-flight of *D. melanogaster* flies of the Cs strain to various odorant stimuli

Life & Health Sciences

GENOME-SCALE ANALYSIS OF DIFFERENTIAL PROPENSITIES OF DIFFERENT CHROMOSOMAL DOMAINS FOR HORIZONTAL GENE INSERTION IN *ESCHERICHIA COLI*

Project No. 5103-3

Apr. 2014 to Apr. 2018

Background

Horizontal gene transfer is a major force in bacterial evolution. It is regulated at multiple levels, from acquisition to gene expression. This regulation is believed to emerge among other things, from the structure of the chromosome itself, as well as from the action of DNA-binding proteins such as H-NS. The project aims for use of a combination of comparative genomics, systems biology, and novel applications of next-generation sequencing technologies to address the contributions of the above factors in the insertion of acquired genetic loci in *Escherichia coli*. Specifically, it is proposed to use a combination of publicly available data and new chromosome conformation capture experiments to define structural domains of the genome. Using comparative genomics and a semi-quantitative measurement of relative frequency of transposon insertions into the genome, statistical tendencies for genomic islands to be inserted and fixed in specific chromosomal contexts.

Objectives

- Description of the propensities of specific chromosomal loci and structural elements of the chromosome to be more receptive to horizontal gene integration, using a combination of comparative genomics and transposon mutagenesis
- The impact of specific chromosomal contexts identified in part 1 on gene expression levels and population variability thereof
- Development of novel methods applying deep sequencing data towards achieving these objective and the establishment of a publicly available web-server presenting our data and analysis

Knowledge Generated / Products Developed

Discovery of a large chromosomal rearrangement – duplication of 40% of the chromosome centred around the origin – which suppresses the growth defect of desilencing horizontally-acquired genes encoded around the terminus of replication

Principal Collaborators



Aswin Sai Narain Seshasayee
Tata Institute of Fundamental Research
Bangalore



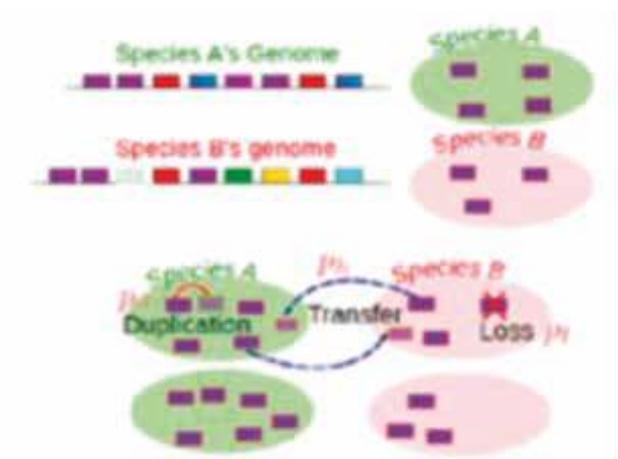
Marco Cosentino Lagomarsino
UMR 7238 CNRS
University Pierre and Marie Curie
Paris

Publications

- No. of publications in SCI journals : 3
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: 2



DECIPHER THE SYMBIOTIC PROGRAM IN TROPICAL LEGUMES

Project No. 5103-4

Jun. 2014 to May 2017

Background

Understanding the ‘molecular code’ associated with root nodule symbiosis (RNS) between plants and nitrogen-fixing bacteria is necessary for evaluating the prospects for extending symbiosis beyond current host range to reduce or eliminate the broad usage of fertilizers in our agricultural practices. To address this question the temperate legumes that have been retained as study models have unravelled a sophisticated infection process. However, an alternative mode of infection has been described in tropical Mediterranean legumes including *Arachis hypogaea* and *Aeschynomene evenia*. Those aeschynomene legumes share an intercellular infection pathway considered to be the ancient mode of invasion of plant tissues and thus expected to have a relatively simple molecular code for RNS. Their efforts would identify the transcriptome involved in early global response associated with inception of symbiosis in *A. hypogaea* and *A. evenia* and allow comparing results obtained for each plant in order to discover common and/or divergent molecular actors implicated in such tropical symbiosis.

Objectives

- Characterization of *Arachis hypogaea* symbiotic transcriptome using Illumina flow cell run of sequencing
- Bioinformatics analysis of transcriptomic data sets generated from *Arachis hypogaea* and *Aeschynomene evenia*
- Identification of common and / or divergent molecular factors implicated in such tropical symbioses
- Identification of candidate genes associated with the early events like recognition/ signaling and endocytosis of the microsymbiont.
- Functional analysis of candidate genes via RNA interference, analysis of their spatiotemporal expression pattern by qRT-PCR promoter/reporter gene fusion

Knowledge Generated / Products Developed

- The *Arachis hypogaea* transcriptome project was launched with MGX Genomix France on September 2014 who are also handling the *A evenia* project for the French Group
- The progress of symbiosis in *Arachis* is divided into 5 different stages. RNA prepared from these stages is being sequenced by MGX, France, the analysis and output is awaited
- A Nod deficient *Bradyrhizobia* BTAi1 nodulates *Arachis* indicating this legume to support Nod independent nodulation
- A broad host range *Bradyrhizobia* ORS285 fails to nodulate *Arachis*. Normal nodulation by ORS 285ΔTSS indicates presence of negative T3SS effectors in ORS285

Principal Collaborators



Maitrayee Das Gupta
University of Calcutta
Kolkata



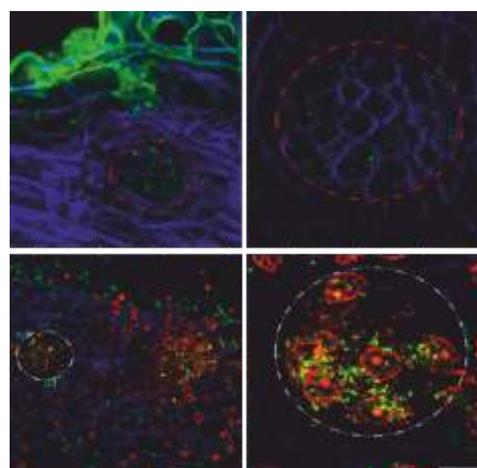
Fabienne Cartieaux
Laboratoire des Symbioses Tropicales & Méditerranéennes (IRD) Montpellier

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 5
- France to India: 2



In stage 2 at 4DPI we found bump like structure in *Arachis* root where a cluster of cells with large nucleus and no cell wall were infected with rhizobia. In case of *A. evenia* these infected cells were noted after 2DPI but these cells did not appear to have large nucleus.

MAGNETIC NANOPARTICLES FOR HYPERTHERMIA AND SPINTRONICS

Project No. 5104-1

Apr. 2014 to Dec. 2017

Background

Magnetic nanoparticles (MNPs) synthesized by chemistry have applications in diverse fields such as nanoelectronics, catalysis, biomedicine, etc. The aim of the project is at combining experimental, theoretical and computational studies on assemblies of MNPs for two focused applications: magnetic hyperthermia and spintronics. In both these applications, the magnetic interactions between MNPs strongly influence the system properties (e.g., heat dissipation in the former and amplitude of the tunnel magnetoresistance in the latter). The Indian partner has developed theoretical and computational tools to understand the role played by interactions and system parameters on the non-equilibrium properties of aggregates and suspensions of MNPs. The French partner has developed an expertise in the magnetic and magnetotransport measurements on assemblies of MNPs. During their collaboration, the two groups will converge towards the elaboration, measurements and simulations of model systems on which joint experimental and theoretical studies will be carried out.

Objectives

- To identify model systems for efficient experimental and theoretical comparisons for magnetic hyperthermia and spintronics
- To develop numerical simulations for the hysteresis loop calculation of assemblies of MNPs
- To study theoretically the influence of external parameters, in particular the anisotropy, size, disorder, concentration and aspect ratio
- To measure very precisely the structural properties of the model systems using electron microscopy
- To study experimentally the magnetic properties of the model systems
- To bring convergence between theoretical calculations and experiments (by Finetuning parameters)

Knowledge Generated / Products Developed

- (a) Preparation and characterisation of Fe_2SiO_5 MNP_s for use as a model system in hyperthermia. (b) Synthesis of FeCo MNPs and Au or Pt NPs linked with spin crossover compounds for spintronics. (c) Heating power and high-frequency hysteresis loop measurements on the Fe_2SiO_5 system
- Development of mean field theory and formulation for calculation of hysteresis loops and area scaling laws for assemblies of MNPs (aggregates, beads, etc.)
- Development of e-beam lithography process to elaborate nanoscale electrodes for transport measurements (b) Integration of hybrid nanoparticles composed of Pt or Au combined with magnetic spin-crossover molecules. (c) Low-temperature transport measurements on these systems. (d) Development of protocols to integrate magnetic particles into the devices
- Development of Ewald summation technique to handle dipolar interactions in MC simulations for assemblies and arrays of MNPs

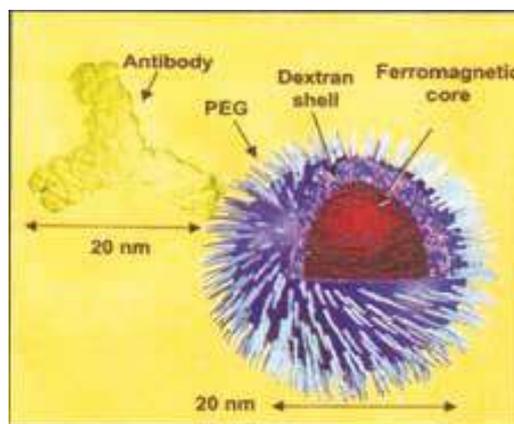
Principal Collaborators



Varsha Banerjee
Indian Institute of Technology Delhi
New Delhi



Julian Carrey
Laboratoire de Physique et Chimie des
Nano-Objets INSA Toulouse



Publications

- No. of publications in SCI journals : 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: 1

Pure & Applied Physics

SELF-SIMILAR OPTICAL PATTERNS IN NONLINEAR MEDIA

Project No. 5104-2

May 2014 to Apr. 2018

Background

Self-similarity is one of the fundamental dynamics observed in many fields of science (optics, hydrodynamics, cosmology), as well as occurring in natural environment (plant growth, etc.). Very recently, the implementation of this concept into nonlinear optics has produced a tremendous development among key subjects such as optical amplifiers and supercontinuum generation, propagation in tapered step-index and graded-index fibers, as well as in photonic-crystal fibers, mode-locked lasers dynamics and optical rogue wave formation. The project will combine the theoretical and experimental expertise of both Indian and French groups to develop innovative applications of the self-similar concept and intent to solve some of the open questions in the above areas. Parameter-management in dissipative nonlinear systems shall be a central work, since it represents the step forward to implement the concept into realistic experimental situations, such as laser sources, with a view to developing advanced coherent pulse sources, in terms of pulse peak power and pulse width.

Objectives

- Extension of supercontinuum generation in photonic-crystal fibers (PCF)
- Self-similarity in the presence of high-order terms
- Scaling laws for pulse trains and ultra-high repetition rate optical source development
- Self-similar lasers for high-energy pulse delivery
- Scalable optical rogue wave formation

Knowledge Generated / Products Developed

- A variety of AS2S3 chalcogenide photonic crystal fiber coupler of special properties are proposed to study the role of birefringence in all optical coupling characteristics based on the projection operator method (POM)
- MI in different optical media has been investigated
- Rogue wave solutions of optical systems have been constructed and reason for the occurrence of rogue wave theory has been proposed
- Nonlinear chirping has been constructed with different higher order dispersion and nonlinear optical effects
- Impact of temperature on Supercontinuum in Water filled PCF has been investigated

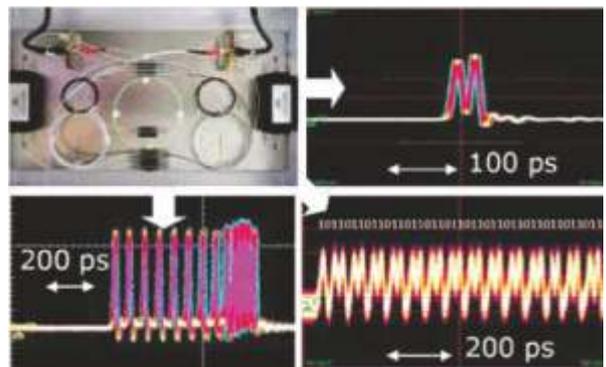
Principal Collaborators



K. Porsezian
Pondicherry University
Pondicherry



Ph. Grellu
UMR 6303 CNRS- Université
Bourgogne Franche-Comté
Dijon



Publications

- No. of publications in SCI journals : 14
- No. of papers presented in conferences: 8

Mobility Support

- India to France: 1
- France to India: 1

Illustration of the diversity of multi-pulse dynamics that can be generated from a single fiber laser unit, when the cavity parameters are altered. A goal of our project is to extend the scaling of these regimes, for instance to access to high-repetition rate laser pulse emission, through different physical mechanisms at play in dissipative nonlinear systems

Pure & Applied Chemistry

GLYCOCHEMICAL STUDIES ON MYCOBACTERIAL ARABINOMYCOLAT

Project No. 5105-1

Apr. 2014 to Mar. 2017

Background

Mycobacterium tuberculosis (MTb) causes Tuberculosis (TB), a century old disease that still kills more than 2 million humans annually. MTb cell surface among others has characteristic furanosyl form of arabinose & galactose, cyclopropanated lipids. Ethambutol, a drug used for the treatment of TB, found to arrest the arabinan biosynthesis; glycolipids of MTb are currently under investigation as targets for drug discovery. Presence of xenobiotic furanosyl forms of arabinose, galactose and cyclopropanes in the lipids can raise a few questions: (i) why MTb chose furanoses over pyranoses; (ii) why MTb chose Araf over other pentoses; (iii) why MTb cell wall has rare cyclopropanes; (iv) Is there any relation between arabinolipid of MTb and its survival under extreme conditions? The project addresses them through physicochemical studies on a library of arabinofuranosyl lipids exploiting modern spectroscopic and microscopic techniques. Results from this study might pave way to the design of newer drugs which can target glycolipids.

Objectives

To unravel the physicochemical significance of the glycolipids present in the cell wall of *Mycobacterium tuberculosis*:

- Development of chemistry for the synthesis of arabinolipids
- Chemoenzymatic synthesis of glycolipids
- Synthesis of glycolipids library
- Solvation dynamics by THz spectroscopy
- Physico-chemical studies on glycolipids
- *In vitro* Biological evaluations

Knowledge Generated / Products Developed

- Development of chemistry for the synthesis of arabinolipids
- Chemoenzymatic synthesis of glycolipids
- Synthesis of glycolipids library
- Solvation dynamics by THz spectroscopy
- Physico-chemical studies on glycolipids

Principal Collaborators



Srinivas Hotha
Indian Institute of Science Education
and Research
Pune



Thierry Benvegnu
Ecole Nationale Supérieure de
Chimie de Rennes
UMR CNRS 6226, Rennes

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: Nil
- France to India: Nil



Du Nouy tensiometer

Pure and Applied Chemistry

MOLYBDENUM-CONTAINING ENZYMES: BIOINSPIRED PEPTIDIC CATALYSTS FOR CO₂ REDUCTION

Project No. 5105-2

Jun. 2014 to Nov. 2017

Background

In a context of the limitation of fossil fuels, it is imperative to develop research aimed at enhancing CO₂. One of the most promising approaches is to transform it into reduced carbon forms that can generate hydrocarbons. But CO₂ is a very stable molecule, chemically difficult to activate. However, enzymes present in microorganisms are capable of effectively reducing CO₂ into formate. These enzymes, formate dehydrogenases, have a Mo active site where the catalytic reaction takes place. Inspired by these enzymes, the purpose of this project is to prepare peptide biomimetic/bioinspired Mo complexes in order to study and to decipher the molecular factors responsible for this remarkable reactivity to develop new biocatalysts Mo, robust and efficient for the reduction of CO₂.

Objectives

To develop a new class of catalysts capable of achieving the CO₂ reduction in soft conditions, which is a key step in the generation of biofuels in a green chemistry approach

Knowledge Generated / Products Developed

- Synthesis of 2-amino-3-(3,4-dimercaptophenyl) propanoic acid
- Synthesis of Fmoc-protected vinylalanine, will be used for cross coupling reaction to make peptide-based catalyst
- Synthesis of 3-allylbenzene-1,2-dithiol, will be used for cross coupling reaction on peptide backbone
- Synthesis of molybdenum complexes
- First electrocatalytic tests in sulfoxide and CO₂ reduction

Principal Collaborators



Surajit Sinha
Indian Association for the
Cultivation of Science
Kolkata



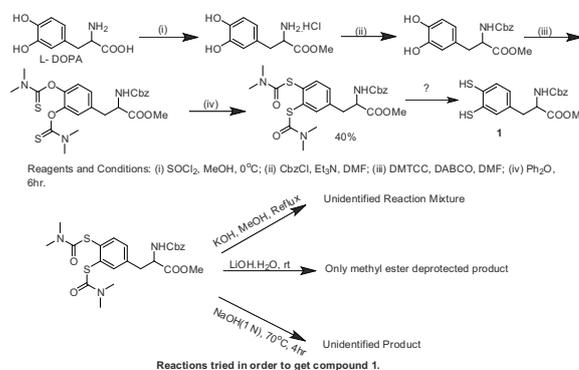
Marius Reglier
Institut des Sciences Moléculaires de Marseille
ISM2 UMR CNRS 7313, Aix-Marseille Université
Aix-Marseille

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 2



Pure & Applied Chemistry

PHOSPHORUS-SUPPORTED MULTISITE COORDINATING LIGANDS FOR THE ASSEMBLY OF POLYNUCLEAR HETEROMETALLIC (3d-4f) AND HOMONUCLEAR (3d) ENSEMBLES: TOWARDS A NEW GENERATION OF MOLECULAR MAGNETIC MATERIALS

Project No. 5105-3

May 2014 to Apr. 2017

Background

The number of polymetallic cages reported increases every year and to date, approximately more than hundred SMMs have been reported - yet the barrier height for the reversal of magnetisation has not been significantly raised. Therefore the synthesis of a new generation of single molecule magnets with enhanced properties is still a major challenge. This project aims at synthesizing new generation magnetic materials based on polynuclear homo-(3d) and heterometallic (3d-4f) complexes.

Objectives

- Design and assembly of novel phosphorus-supported multi-site coordinating multi compartmental ligands
- Syntheses and structural characterization of polynuclear homo- (3d) and heterometallic (3d-4f) complexes with an emphasis on varying the transition metal ions (number of d electrons and their nature, t_{2g} vs eg; magnetic anisotropy), their 3 geometry (5, 6 and 7-coordinate, regular vs. distorted geometry), the lanthanide ions and the ligands
- To study the possible SMM properties of the isolated 3d-4f hetero metallic complexes and to gain an understanding of the structural factors in terms of their impact on magnetic behavior. They would utilize Co(II) as the 3d metal ion in preparing 3d metal ion complexes. Although Co(II), with its strong spin-orbit coupling is a natural choice in design of SMMs, surprisingly the studies utilizing this metal ion alone are very limited
- To utilize discrete magnetic building blocks for the construction of novel SCMs and to study their magnetic behaviour

Knowledge Generated / Products Developed

- Designing and assembling of novel phosphorus-supported multi-site coordinating multicompartamental ligands. It is shown that utilizing hexakis (3-pyridyloxycyclotriphosphazene) it is possible to obtain molecular, 1D- and 2D-coordination polymers. Using acyclic nitrogenous multicompartamental ligand one can obtain 1D-coordination polymers with dinuclear 4f motifs
- Syntheses and structural characterization of polynuclear homo- (3d and 4f) and heterometallic (3d-4f) complexes with an emphasis on varying the transition metal ions (number of d electrons and their nature, t_{2g} vs eg; magnetic anisotropy), their geometry (5, 6 and 7-coordinate, regular vs. distorted geometry), the lanthanide ions and the ligands
- Discrete magnetic building blocks for the construction of novel SCMs and study their magnetic behavior intensively
- Synthesis, structure and magnetic studies on the following 3d-4f heterometallic families has been completed
 - a) Ni_2Ln_4 and Ni_2Y_4 compounds
 - b) Mn_2Ln_4 family

Principal Collaborators



Vadapalli Chandrasekhar
National Institute of Science Education and
Research (NISER) Bhubaneswar



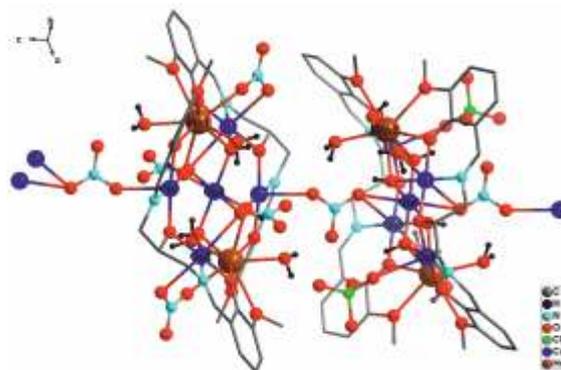
Hab. Rodolphe Clérac
Centre de Recherche Paul Pascal (CRPP)
UPR CNRS 8641
Equipe "Matériaux Moléculaires Magnétiques"
Pessac

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: 1



Ball and stick view of the repeating unit of the 1D coordination assembly containing two $[Cu_5Ho_2]$ complexes in 3. All hydrogen atoms (except those from hydroxido groups and coordinated water molecules) and solvent molecules have been omitted for clarity

Pure & Applied Chemistry

sp³ C-H BOND ACTIVATION WITH RUTHENIUM(II) CATALYSTS: APPLICATION TO THE SYNTHESIS OF ALIPHATIC N-HETEROCYCLIC NATURAL PRODUCTS

Project No. 5105-4

Jul. 2014 to Jun. 2017

Background

The aim of the project is the development of new Ruthenium based catalysts, their utilization for the sp³ C-H bond activation en route to the synthesis of diverse scaffolds and Target Oriented Synthesis (TOS) of natural products. Thus, both the teams have excellent complementarities in their expertise, having produced original results in their respective fields, to carry out the proposed activity. The efforts of both the teams together would result in novel catalysts for C-C and C-N bond formations, leading to diverse scaffolds with chirality. The contributions from the collaboration of the two teams from Rennes (France) and Hyderabad (India), would expand the domain of C-H bond activation, with the emphasis in the area of asymmetric TOS of natural products and inspired molecules.

Objectives

- To design and evaluate new ruthenium (or iridium) catalysts for sp³C-H bond activation
- To design and synthesize alicyclic nitrogen containing scaffolds (pyrrolidines, piperidines, piperazines, fused bicyclic amines)
- To establish appropriate reaction conditions for the metal catalyzed C-C and C-N bond formation with benzylic, allylic alcohols, diols and dialdehydes
- To apply ruthenium catalysts for the Target Oriented Synthesis (TOS) of nitrogen containing natural products
- To prepare chiral ruthenium complexes using non-natural amino acids (β 3-, β 2-, β 2,2- and 4-) with carbohydrate side chains
- To explore chiral ruthenium complexes for the enantioselective C-C bond forming reactions through the C-H bond activation

Knowledge Generated / Products Developed

- Synthesis of chiral diols to conduct cyclization reactions
- Synthesis of intermediates for chiral β amino acids / diamines
- Synthesis of chiral morpholine and piperazine derivatives for cyclization reactions
- Synthesis of polycyclic and heterocyclic amines via N-C, CC and C-O bond formation based on cascade catalytic transformations
- New ligands and transition metal catalysts for hydrogen transfer reactions and sp³C-H bond functionalization

Principal Collaborators



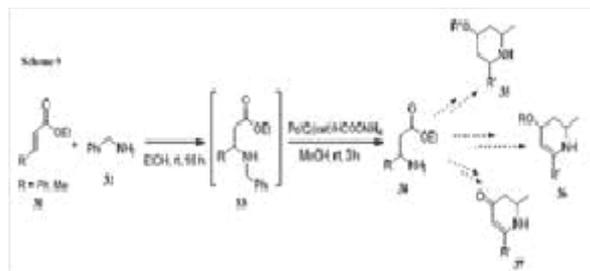
G. V. M. Sharma

CSIR-Indian Institute of Chemical Technology
Hyderabad



Christian Bruneau

UMR 6226: Institut des Sciences Chimiques
de Rennes (ISCR) Organométalliques :
Matériaux et Catalyse
Université de Rennes 1, Rennes



Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 2
- France to India: 2

Materials Science

SYNTHESIS OF PHOTOCATALYTIC POROUS SILICON-CONTAINING NITRIDE AND OXYNITRIDE NANOCOMPOSITES

Project No. 5108-1

May 2014 to Oct. 2017

Background

The project envisages the synthesis and characterization of porous silicon-containing (oxy) nitride nanocomposites as foams and membranes via the Polymer-Derived Ceramics (PDCs) route. The idea behind the project is to prepare nanocomposites in which titanium and/or zirconium oxide/oxy-nitride/nitride nanocrystals are formed during the synthesis of the silicon nitride and silicon oxynitride matrices with photocatalytic activity & adsorbent capacity (by immobilizing adsorbents in the porosity of materials) concomitantly being stable in severe conditions. A complete characterization of the structure, kinetics of crystallization, mechanical & phase stabilities will be performed. The photodegradation of dye and photoassisted H₂ production will be investigated. Performing thermodynamic calculations and combining experiments with computational approaches provide a comprehensive picture to exhibit immense scientific potential & industrial applications.

Objectives

- Preparation of Si-based (oxy)nitride ceramic nanocomposites foams/membranes;
- Use the nanocomposites to immobilize/anchor adsorbents
- Structural Characterization & Evaluation of Mechanical Stability
- Thermochemistry and Phase relations
- Evaluation of the photocatalytic activity and adsorbent capacity

Knowledge Generated / Products Developed

- *In-situ* synthesis of (a) SiOC/TiO₂, (b) SiOC/TiCN (c) SiON(C)/TiN foam, (d) SiOC/ZrO₂ from polysiloxanes, (e) mesoporous Si₃N₄ monoliths from polysilazanes, (f) mesoporous TiN/Si₃N₄ monoliths from polytitanosilazanes and (g) SiBCN foams from boron-modified polysilazanes
- Structural characterisation of the above developed porous materials
- Mechanical and textural characterisation
- Evaluation of catalytic and photocatalytic activity of (a), (b), (e), (f) and confinement of adsorbents (g)
- Reassessment of N-Zr, and assessment of Ti-Zr-N, Si-Zr-N thermocalc software
- Synthesis and characterization of mesoporous 3D supports for metal catalysts made from Si-based nitrides/carbides/carbonitrides
- Synthesis and characterization of Si₃N₄-TiN nanocomposite as a 3D mesoporous support for metal catalyst in hydrogen generation reaction from chemical hydrides and as adsorbent material for dye removal
- Mechanisms governing the preparation of polymers Chemical reactions involved during the polymer-to-ceramic conversion

Principal Collaborators



Ravi Kumar, N. V
Indian Institute of Technology Madras
Chennai



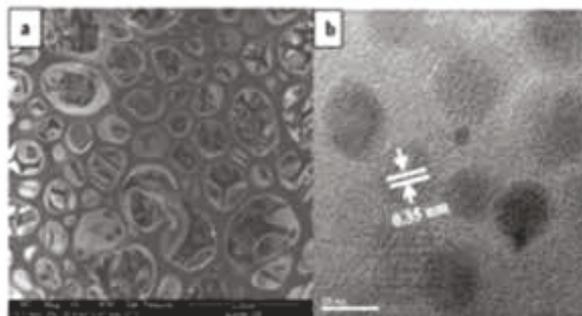
Samuel Bernard
Institut Européen des Membranes
IEM
Montpellier

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 10

Mobility Support

- India to France: 1
- France to India: Nil



a) Structure of porous SiOC/TiO₂ nanocomposite with interconnected cell walls and (b) Titania (anatase) nanoparticles in an amorphous SiOC matrix

Environmental Science

SURVEY OF SOIL-Si POOLS AND CONTRIBUTION OF Si FERTILIZATION IN A SUSTAINABLE RICE CULTIVATION IN SOUTH INDIA

Project No. 5109-1

Apr. 2014 to Apr. 2018

Background

Si is generally not considered as an essential nutrient for crops but many studies have proven its benefits for improving their yields, specifically for rice, a Si accumulator species. The application of silicon fertilizers has the potential to mitigate environmental stresses and soil nutrient depletion and as a consequence constitutes an alternative to the extensive use of phyto-sanitary and NPK fertilizers for maintaining sustainable agriculture. The integration of Si in agricultural practices is therefore effective in a few countries but not yet in India. The project will combine field and laboratory experiments to analyze Si speciation in the water/soil/plant compartments of aerobic and wetland rice ecosystems in order to assess if the South Indian soils are depleted in bioavailable Si. Various techniques will be used including mineralogical, chemical and isotopical techniques. The results will be used for improving the potential benefits of the Si fertilizers in sustainable rice cultivation practice in South India.

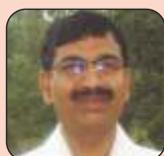
Objectives

- To characterize status of Si in the South Indian rice soils
- To assess the Si budget in wetland rice ecosystems
- To assess the bioavailability of different sources of Si in rice cropping system in acidic, neutral and alkaline soils

Knowledge Generated / Products Developed

- Mineralogy and geochemistry of 18/40 samples representing different agro climatic zones have been performed
- Quartz, Na and K feldspars, amphibole, and phyllosilicates (chlorite, muscovite) are the main primary minerals identified in most of the samples
- The bioavailable Si pools are assessed by 3 extractants: CaCl₂ for immediate dissolved Si; acetic acid for Si adsorbed on iron oxides mainly and Na₂CO₃ for amorphous silica and a fraction of clay minerals
- The first season experiment on budgeting of silicon in rice field was a great success. The first analytical results reveal that the application of Si slightly increased the yields
- Pot experiments reveal that contrary to what is generally stated, clay minerals can be a significant source of Si for rice

Principal Collaborators



N.B. Prakash
University of Agricultural Sciences
Bangalore



J.D. Meunier
CEREGE, UM 34 Aix Marseille Université
CNRS IRD
Aix en Provence

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 3
- France to India: 3



Field Experiment at VC Farm, Mandya to monitor budgeting of silicon in rice plot during summer 2015

MOLECULAR STUDY OF RH GENE VARIANTS IN INDIANS

Project No. 5203-1

Mar. 2015 to Mar. 2017

Background

Among the 33 human blood groups, the Rh system is the most complex and polymorphic. It is linked to the two highly homologous RHD and RHCE genes including numerous variants that encode highly immunogenic surface antigens specifically expressed in red blood cells. Rh status of donors and patients is then a major concern of Public Health, especially in transfusion and obstetrical medicine. So far, little is known about the RH genetics in the heterogeneous Indian population. This project aims to identify and characterize the RH gene variants in Indians by combining the technical and scientific expertise and skills of the National Institute of Immunohaematology (NIIH, Mumbai, India) and the Blood Group Molecular Genetics Laboratory (EFS-Inserm U1078, Brest, France) in blood group phenotyping and genotyping, respectively. Beyond the scientific interest of this study, valuable data will help Indian physicians to guide transfusion medicine practice and to manage the alloimmunization risk in pregnant women.

Objectives

- To provide a molecular pattern of distribution of both the RHD and RHCE gene variants in the Indian population
- To define potential novel population-specific variants/clusters
- To delineate correlation between phenotypes and genotypes by functional studies

Knowledge Generated / Products Developed

- Molecular bases of weak D phenotype in the Indian population
- Molecular bases of RhD negativity in C/E+ Indian donors
- Molecular bases of Rh_{null} phenotype in two Indian families

Principal Collaborators



Swati Kulkarni
National Institute of Immunohaematology
KEM Hospital
Mumbai



Yann Fichou
Etablissement Français du Sang –
Bretagne, INSERM UMR1078
Brest

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: Nil

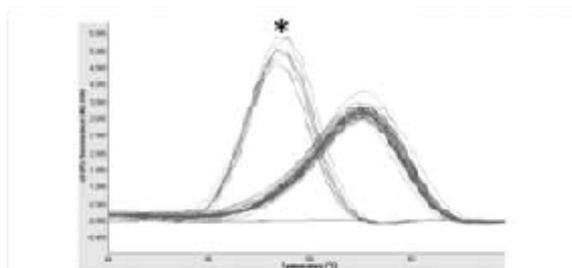


Figure 2. Example of melting curves after specific amplifications for the genotyping of the weak D, type 3 allele in 43 DNA samples. * Weak D, type 3 samples.

INSIGHTS ON PROTEIN STRUCTURAL AND EVOLUTIONARY DYNAMICS

Project No. 5203-2

Mar. 2015 to Feb. 2018

Background

Conformational flexibility of proteins is an essential consideration to understand the mechanistic basis of biological function. Variability in the 3-D structures of homologous proteins contributes to subtle or major functional diversity. The current project addresses three dimensions in the general theme of similarities and variations in structural and evolutionary dynamics of proteins and implications for recognition of functional sites. (1) Based on the recent joint publication on the allostery, the collaborators propose to employ protein blocks (PB) based analyses, normal mode analysis and molecular dynamics simulations on tertiary structures of proteins and modular complexes to predict allosteric sites in proteins. (2) To identify non-canonical functional sites in protein kinases using evolutionary trace analysis, normal mode analysis and PB analysis. (3) Extract information on structural dynamics from NMR ensembles and compare it with evolutionary dynamics derived from structures of homologues to understand permissive structural diversity.

Objectives

- Prediction of allosteric sites in single-domain and multi-domain proteins modulated by protein-protein and domain-domain interactions respectively
- Prediction and structural characterization of non-canonical functional sites in subfamilies of protein kinases
- To extract information on structural dynamics by simulations such as molecular dynamics and Normal Mode Analysis instead of extracting information on dynamics from NMR-derived structures

Knowledge Generated / Products Developed

- For the first time it has been shown that inactive forms of protein kinases are characterized by higher dynamics than active forms
- It has been shown that extent of flexibility of protein kinases is correlated to hierarchical organization of kinases. Moreover, regions of unique flexibility in a kinase correlated to hierarchical organization of kinases
- Regions of unique flexibility in a kinase correspond to functionally sensitive sites
- 3-D structure of human splicing factor SF3b assembly elucidated using an integrated approach and cryo-electron microscopy-derived density maps shows substantial alteration in the structure of component proteins as a consequence of assembly formation
- Local regions of proteins that adopt ordered and disordered forms in different crystal structures are proposed to often contain post-translational modification and allosteric sites

Principal Collaborators



Narayanaswamy Srinivasan
Indian Institute of Science
Bangalore



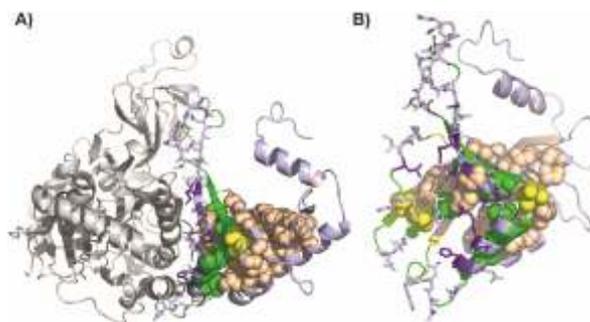
G Alexandre de Brevern
INSERM UMR-S 665
DSIMB
Univ Paris Diderot
Paris

Publications

- No. of publications in SCI journals: 12
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 2



Different residue types. The different residue types studied in this analysis are depicted on the structure of the naphthalene 1,2-dioxygenase beta subunit in complex with the alpha subunit. A) The structure of the complex is shown. The alpha subunit is shown as grey cartoon and the beta subunit as wheat-colored cartoon, with the different residue types shown in differential coloring and shapes. B) The surface residues are colored light blue, the buried residues are shown in spheres, the interacting residues as sticks, the core interacting residues are colored purple, the nearby interacting residues calculated with a 6 Å cut-off in green and those identified with a 8 Å cut-off in yellow.

Life & Health Sciences

HOST-VIRUS INTERACTIONS AND ANTIBODY THERAPY FOR JAPANESE ENCEPHALITIS

Project No. 5203-3

Mar. 2015 to Feb. 2018

Background

The central theme of the project concerns the molecular and biochemical dissection of the immune evasion mechanism of *Japanese encephalitis* virus (JEV) and investigation of novel therapeutic approaches for *Japanese encephalitis*. The precise nature of the interactions of JEV with cells of the innate and adaptive compartments of the host immune system remains to be elucidated, for the development of promising therapeutic measures and new prophylactic candidates with improved efficacy. The cellular PRRs and critical PAMPs of virus involved in pathogenesis will be identified. In the scenario of non-existing JE specific therapy, the novel approach of *in vitro* generated JEV-reactive human monoclonal antibody will provide the promising passive therapy candidate with the potential to translate into preclinical trials in JE.

Objectives

- To understand the mechanism of JEV-host interaction, immune evasion, and virus persistence, with identification of pattern recognition receptors (PRRs) in dendritic cells and CD4+ T lymphocytes and viral envelope protein(s) responsible for binding to the PRRs and mediating viral internalization
- To decipher the role of regulatory T cells in JEV pathogenesis, both *in vitro* and *in vivo*
- To demonstrate the application of CCR4 antagonist in therapy and/or as adjuvant in new vaccine Preparations
- To explore the therapeutic potential of *in vitro* generated JEV-reactive human monoclonal antibodies in *Japanese encephalitis* in a mouse model of disease
- To understand the mechanism of JEV-host interaction, immune evasion, and virus persistence, with identification of pattern recognition receptors (PRRs) in neuronal cells, and fibroblasts and viral envelope protein(s) responsible for binding to the PRRs and mediating viral internalization

Knowledge Generated / Products Developed

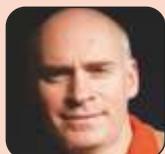
- Establishment of the JEV-envelope protein domain 3 (ED3) as an exploratory molecule to identify the JEV-receptor system
- Identification of GRP78 as a crucial host factor for virus entry and replication in multiple cell types
- Preliminary characterization of JEV interactions with monocytes and dendritic cells and activation of innate immune responses.
- Screening and identification of human monoclonal antibodies with acquired JEV-reactivity
- Biochemical and functional characterization of *in vitro* generated JEV-reactive human monoclonal antibodies
- First steps of the establishment of technology to clone V regions of immunoglobulins at single B-cell level, and express them as recombinant IgG

Principal Collaborators



Manjula Kalia

Vaccine & Infectious Disease Research Centre
Translational Health Science &
Technology Institute
Faridabad



Sebastien Lacroix-Desmazes

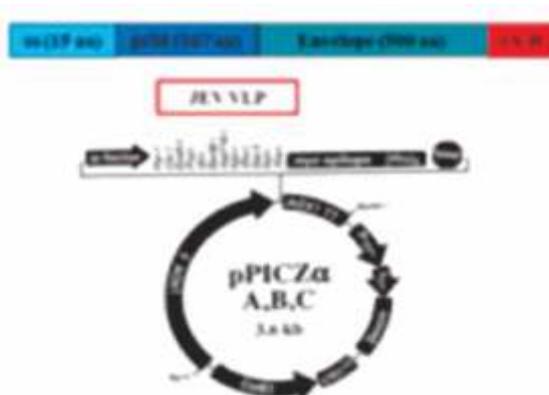
Institut National de la Sante et de la Recherche
Medicale (INSERM)
Paris

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: Nil
- France to India: 1



Strategy for JEV-Virus like particle (VLP) production

Life & Health Sciences

NOVEL INHIBITORS OF NHEJ AGAINST RESISTANT TUMOUR CELLS

Project No. 5203-4

Mar. 2015 to Mar. 2018

Background

The emergence of tumour cells resistant to anti-cancer drugs and irradiation remains the frequent cause of failure of long term cancer therapies. Non-Homologous End-Joining (NHEJ) repair pathway plays a critical role in these resistance mechanisms. A major challenge is to characterize several inhibitors of the NHEJ pathway to increase the efficacy of the anti-cancer treatments against a large spectrum of resistant tumors. The first inhibitors of the NHEJ pathway have been characterized, in particular by the Indian Partner. In this project, the French and Indian Partners will join their highly complementary approaches to identify new inhibitors against two targets: the Artemis nuclease and the XRCC4-Cernunnos complex interaction site. The French Partner will realize protein production, high throughput small molecules screenings, and structural biology. The Indian Partner will realize molecular modelling, functional assays at the molecular, cellular and animal levels.

Objectives

- Expression in insect cells and purification of core NHEJ factors including Artemis, XRCC4-Ligase4 (XL4) and Ku70/Ku80 complexes
- Biophysical characterization and structural studies of XL4, Artemis, and Ku70/Ku80 in complex with ligands
- Design potential ligands of NHEJ inhibitors
- Screening and identification of potent NHEJ inhibitors
- Biological characterization of lead compound, *in vitro*, *ex vivo* and *in vivo*
- Investigation in radiation resistant cancer cells, alone or in combination with established chemo and radiotherapeutic agents
- -Ku70/Ku80 proved to be a major target since first crystals were obtained with this complex and different peptides

Knowledge Generated / Products Developed

- Expression and purification in high yield of XL4, Artemis, Ku70/Ku80, XLF
- Characterization by microcalorimetry of interactions of NHEJ factors with ligands
- Crystallization screenings of NHEJ factors and crystal structures of Ku70/Ku80 with peptidic ligands
- Virtual screening and identification of potential Ligase, XRCC4 and KU inhibitors
- Identification of different forms of SCR7 and their biological activity including specificity

Principal Collaborators



Sathees C. Raghavan
Indian Institute of Science
Bangalore



Charbonnier Jean-Baptiste
IBITECS, CEA Saclay
CE Saclay

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 2

Mobility Support

- India to France: 1
- France to India: 2



Crystals of Ku70/Ku80 heterodimer complexed with a DNA substrate and a potential inhibitor of the NHEJ pathway bound to the heterodimer. Crystals are rod shape with maximum size 300µm x 40µm x 40µm

Life & Health Sciences

CHARACTERISATION OF FACTORS THAT DETERMINE THE BALANCE BETWEEN GENOMIC INTEGRITY AND DIVERSITY IN *HELICOBACTER PYLORI*

Project No. 5203-5

Mar. 2015 to Mar. 2018

Background

Helicobacter pylori is a major bacterial human pathogen, it colonises 50% of the human population responsible for gastritis, peptic ulcers and lymphomas. High level of genetic recombination provides *H. pylori* the ability to diversify, colonize, adapt, evade host immune responses and acquire antibiotic resistances. Thus, understanding the cellular pathways of transformation, recombination and its barriers becomes necessary. The aim of the proposed study is to understand interaction between these pathways during life cycle of *H. pylori*. Collaborators will address these questions by understanding the function of different proteins participating at different stages of these pathways. Genetic studies, cellular localization, protein-protein interaction studies and biochemical characterization of these proteins will allow to understand how these pathways help in diversification of *H. pylori* while maintaining its genomic integrity.

Objectives

- Functional characterization of *H. pylori* proteins (DprA, RecA and MutS2) involved in important stages of natural transformation and recombination pathways to understand mechanistic details of the process
- To study the role of *H. pylori* R-M systems in controlling genetic exchange
- Interaction studies between proteins of natural transformation, recombination and restriction.
- Cellular localization studies with R-M system and proteins involved in natural transformation and recombination

Knowledge Generated / Products Developed

- Identification a new nuclease activity of MutS2 and its impact in transformation.
- Determination of the role of the NTP binding and hydrolysis activities of MutS2 in the competence of *H. pylori*
- Development of an in vivo cell imaging system to monitor transforming DNA internalisation in real-time
- Determination of the role of TypeII Restriction-modification system in the competence of *H. pylori*
- Discovering a new form of epigenetic regulation in *H. pylori*

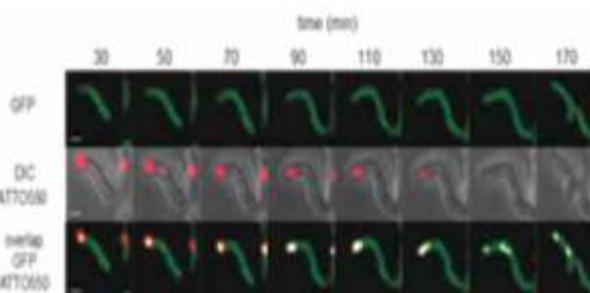
Principal Collaborators



D. Narasimha Rao
Indian Institute of Science
Bangalore



J. Pablo Radicella
Institut de Radiobiologie Cellulaire et
Moléculaire Commissariat à l'Energie
Atomique, (CEA) 18 route du Panorama
92265 Fontenay aux Roses



Direct visualization of the internalisation of exogenous DNA during *Helicobacter pylori* transformation

Publications

- No. of publications in SCI journals : 3
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: 2

Pure & Applied Physics

MONOMODE AND MULTIMODE PHASE SENSITIVE AMPLIFICATION AND LIGHT STORAGE

Project No. 5204-1

Feb. 2015 to Jan. 2018

Background

Potential applications of microwave photonics links in radiofrequency (RF) systems require to generate very stable RF oscillators, to amplify the RF signal and to be able to control the signal group velocities, without degrading the signal-to-noise ratio. Collaborators propose to work on these different aspects with both a fundamental and an applied point-of-view. The key point of this project is phase sensitive amplification that will be both studied for realizing a very low noise amplifier based on highly nonlinear fibers and for a more fundamental work on multimode amplification in a gas cell at room temperature. This system is also very promising for light storage. Another important point in two frequency VECSEL technology, which should allow us to conceive very low noise RF local oscillators based on the beat note between both lasing modes, that can be used in an RF link together with the fiber amplifier.

Objectives

- Phase sensitive amplification in fibers; To conceive noiseless amplifiers using nonlinear optical fibers for application to the transport of microwave signals and the design of low noise optoelectronics oscillators
- Two frequency VECSELS; To study and lower or even remove the coupling of the intensity and phase noises in dual-frequency solid laser
- Phase sensitive amplification in metastable helium; To study phase sensitive amplification in metastable helium. To demonstrate and study light storage using Λ and tripod systems in helium

Knowledge Generated / Products Developed

- Phase sensitive amplification in fibres; The first architecture (1 pump) was implemented and theoretical simulations were performed to optimize the second one (2 pumps)
- Two frequency VECSELS; The role of the thermal noise was modeled and a new VECSEL was designed at 1.5 μm
- Phase sensitive amplification and light storage in metastable helium; Phase sensitive amplification in metastable helium was recorded in metastable helium in different configurations, and we now work on a theoretical model and on the implementation of squeezing detection. Simulations of CPO were achieved but some discrepancies are currently studied

Principal Collaborators



Rupamanjari Ghosh
Shiv Nadar University
Greater Noida



Fabien Bretenaker
Laboratoire Aimé Cotton
CNRS
Fontenay aux Roses



Set up for phase sensitive amplification in metastable helium. The helium cell is in the metal cylindrical shielding. The amplification is already visible

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: 2

RADIO PROPERTIES OF CLUSTERS AND GALAXY LENSES

Project No. 5204-2

Mar. 2015 to Mar. 2018

Background

One of the most fundamental problems in astrophysics concerns the processes by which large scale structures such as clusters and Mpc-scaled galaxies formed and evolved from the extremely smooth universe. Radio observations provide a key solution to this problem via probing the morphology, mass distribution, star formation rates and structure formation from sub-galaxy to cluster scales. In this project collaborators aim to provide the most complete set of radio data (ALMA, GMRT and IRAM) on clusters and galaxies (within cluster environment) lying at redshift range $0 < z < 5$ (epoch of star formation).

Objectives

- Studying diffuse non-thermal emission and magnetic field in 25 Lensing clusters of galaxies ($0 < z < 1$) from the CLASH catalog and studying the SFR and emission line properties of faint galaxies ($0 < z < 5$) in the distant Universe using gravitational lensing technique. Studying the nature of lensing clusters using multi-wavelength (MUSE, GMRT, IRAM, ALMA) data
- Search for lens systems (galaxy-galaxy, cluster-galaxy) from the VLA and Green Bank survey and study their nature using multi-wavelength data
- Studying the diffuse non-thermal emission in Giant radio galaxies within the cluster environment and beyond Multi-wavelength (radio/mm/optical) properties of Giant Radio Galaxies

Knowledge Generated / Products Developed

- Discovery of about 100 new Giant Radio Galaxies and Giant Quasars of >1 Mpc in radio size
- Discovery of 4C 35.06, an extremely unusual radio galaxy associated with multiple galactic black-hole mergers in the centre of galaxy cluster Abell 407 (Zwicky's Nonet)
- Discovery of an extraordinary rare massive spiral galaxy ejecting 1.6 Mpc scale radio jets and its cold disk of molecular gas feeding the black hole. This is a unique object so far
- Non-thermal emission in 14 lensing galaxy clusters from our sample have been studied and new mini-haloes have been discovered in cool-core clusters
- SFR and emission line properties of faint galaxies in the nearby and distant (up to redshift 5) Universe using gravitational lensing technique has been made for the galaxies in the field of MACS J0416.1-2403 cluster
- Multi-wavelength study on 14 lens systems have been carried out in order to study the interplay between dark and baryonic matter.

Principal Collaborators



Joydeep Bagchi

Inter University Centre for Astronomy and Astrophysics, Pune



Bruno Guiderdoni

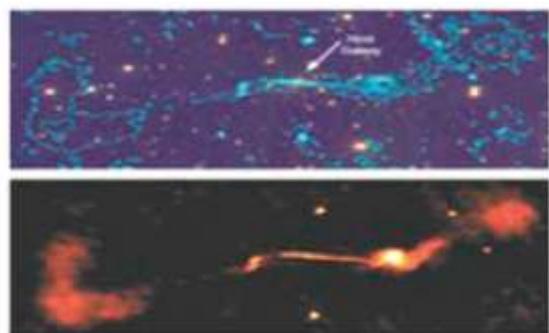
*Centre de Recherche Astrophysique de Lyon
Observatoire de Lyon
Saint Genis Laval*

Publications

- No. of publications in SCI journals : 8
- No. of papers presented in conferences: 8

Mobility Support

- India to France: 4
- France to India: 1



Top Image: GMRT 610 MHz contours overlaid on SDSS colour image to highlight the cluster environment.

Bottom Image: GMRT 610 MHz colour image (5" resolution; rms of about 60 microJy) of Giant radio galaxy. This image clearly shows highly collimated jets getting obstructed on the western side producing hotspot with a kink. Dabhade et al. 2015

Pure & Applied Physics

MODELLING PLASMA INSTABILITIES AND TRANSPORT IN A HALL THRUSTER

Project No. 5204-3

Mar. 2015 to Mar. 2018

Background

Hall effect thruster is a plasma propulsion device, whose studies have shown its suitability for station keeping, orbit control and interplanetary missions. In the proposed project, collaborators shall develop analytical models and carry out simulations of different instabilities likely to be responsible for anomalous electron transport through the magnetic field of Hall thrusters and shall give a quantitative estimate of the electrons flux generated by each of those instabilities using a Hamiltonian formalism. This project is a first step toward a modeling of the electron transport itself that will make it possible to build predictive simulations of Hall thrusters (not available presently). Such simulation would make it easier to optimize the magnetic configuration and the geometry of thrusters in order to improve its performance. Instabilities identified as possible candidate to generate electron transport are a Rayleigh-Taylor like instability, the resistive instability and a kinetic instability.

Objectives

- Investigations of stability of plasma under the effect of different profiles / gradients of magnetic field
- Studies on stability of plasma under the effect of impurity / dust grains in a Hall thruster
- Introducing Hamiltonian formalism to get an estimate of the electron transport driven by instabilities
- Quasi-linear equation for electron transport

Knowledge Generated / Products Developed

- Derivation of Rayleigh-Taylor equation for different profiles of density and velocity
- Theoretical modelling of resistive instability under the effect of impurity
- Theoretical modelling of resistive instability in view of ionization and impurity
- Results for the growth of resistive instability
- Expressions for Lagrangian and Hamiltonian for N particles in the chamber with the coupling of the electromagnetic field in terms of vector potential

Principal Collaborators



Hitendra Kumar Malik
Indian Institute of Technology Delhi
New Delhi



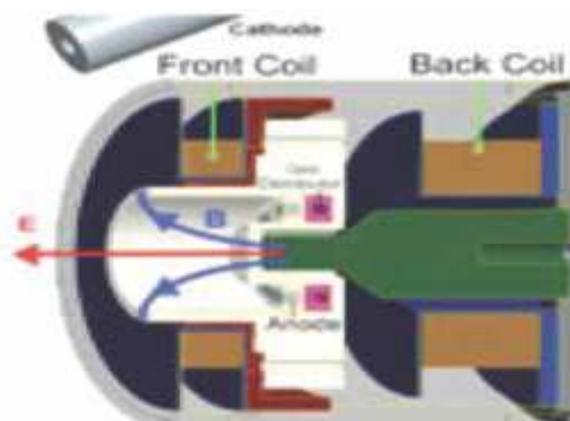
Fabrice Doveil
Physique des interactions ioniques et
moléculaires UMR CNRS 7345
– Aix-Marseille
Marseille

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: Nil



Cross- section view of a cylindrical Hall thruster. Electrons are magnetized and are confined by a combination of the magnetic and electric fields. Segmented anode is shown

Materials Science

PLASTICITY OF COVALENT NANOPARTICLES

Project No. 5208-1

Mar. 2015 to Mar. 2018

Background

Collaborators propose to investigate the plasticity properties of covalent nanoparticles using both first-principles and classical molecular dynamics methods, with materials such as Si, considered as a model and well documented, and SiC, interesting for applications. It is known that nano-objects are characterized by specific properties due to high surface/bulk ratio, and that functionalization is possible by surface modification. Compared to nanopillars/nanotubes, there have been few studies of plasticity properties of nanoparticles. With numerical simulations, collaborators will perform mechanical testing of realistic nanoparticles, in order to determine the elasticity limits and identify the different plasticity mechanisms and their activation domains as a function of size, geometry, and surface state. Mechanisms like dislocation nucleation, twinning, phase transition, and eventually crack nucleation are expected. Moreover studies will be done on core/shell systems, mixing Si and SiC, or using amorphous materials as a surrogate for oxide.

Objectives

- Determination of elasticity limit as a function of size/surface state/geometry of Si and SiC nanoparticles
- Identification of possible plasticity regimes (twinning, dislocation nucleation, phase transition) and their activation conditions,
- Improving mechanical properties by tuning surface state (passivation)
- Investigation of different core/shell systems, such as Si/SiC, or using amorphous Si or SiC as surrogate of oxides

Knowledge Generated / Products Developed

- Determination of structure and linear elastic moduli and generalized stacking fault energy surface of Si from first-principles / Validation of interatomic potentials
- Implementation of external repulsive force fields in the Quantum Espresso package, allowing for ab Initio MD simulations of indentation of Si nano-particles
- Building of Si/SiC nanoparticles in various configurations (bare or H-passivated, spherical or faceted, in core/shell geometry)

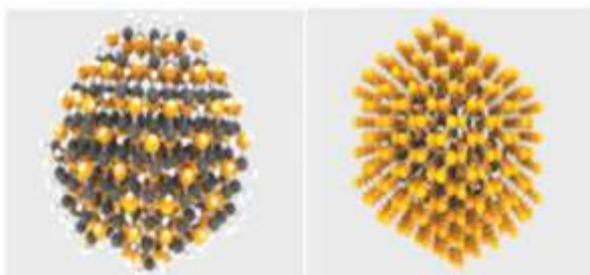
Principal Collaborators



Umesh V Waghmare
Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)
Bangalore



Laurent Pizzagalli
Institut Pprime, CNRS UPR 3346
ISAE-ENSMA – Université de Poitiers
SP2MI
86962 Futuroscope – Chasseneuil Cedex



Two nanoparticles after molecular dynamics relaxation, and prior to mechanical testing (Si: yellow ball, C: black ball, H: white ball).
Left: Hydrogen-passivated silicon carbide spherical system.
Right: Coreshell Si/SiC faceted system

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: 2

Pure & Applied Physics

HOLOGRAPHY AND ITS APPLICATIONS

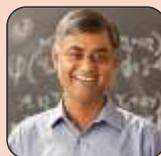
Project No. 5204-4

Jan. 2016 to Dec. 2018

Background

Holography is one of the most important physical insights to emerge from the study of black holes which implies that the number of degrees of freedom in a quantum theory of gravity scales with area and not with volume as one might naively expect. A concrete realization of holography within string theory has led to the remarkable quantum equivalence between a theory with gravity described by strings moving in Anti de Sitter (AdS) space and a theory without gravity described by conformal quantum field theory (CFT) in one less dimension. It is planned to use this duality in two complementary ways : 1) Using known exact quantum results in CFT, it is proposed to develop new methods to study the gravitational effects in AdS at the full quantum level. This will enable a systematic computation of exact quantum corrections to the Bekenstein-Hawking formula going well beyond earlier semiclassical work. 2) It is proposed to use the simplicity of the classical gravitational description in AdS to analyze otherwise intractable strongly coupled dynamics in quantum field theories relevant for certain model systems in condensed matter physics.

Principal Collaborators



Sandip Trivedi
Tata Institute of Fundamental Research
Mumbai



Nick Halmagyi
Université SorbonneLPTHE-UPMC
Paris

Objectives

- To develop effective methods to evaluate the functional integral of quantum gravity in AdS space exactly using the ideas of localization
- To applying above results to study the functional integral in the AdS₂ space
- To understand the physical origin of this mock modularity from the perspective of AdS/CFT holography

Materials Science

NOVEL NANOCATALYSTS SYNTHESIS GUIDED BY DNP NMR

Project No. 5208-2

Oct. 2015 to Sept. 2018

Background

Nanomaterials are essential for the modern society as they can resolve two critical challenges: energy and environment. In particular, novel silica nanomaterials with fibrous morphology offer highly accessible active sites and are promising for various applications including nanocatalysis, non-conventional energy generation (solar cells, water splitting, bio fuels), and environment (CO₂ capture, green chemistry, water purification). However, the development of tunable synthesis and surface modification process for fibrous nano-silica require a better understanding of the structure of surface sites and their interactions with various substrates. This project aims at characterizing these sites and interactions via conventional and DNP-enhanced solid-state NMR. The obtained structural information will be used for a rational improvement of solid base nanocatalysis by nitridated fibrous silica.

Principal Collaborators



Vivek Polshettiwar
Tata Institute of Fundamental Research
(TIFR)
Mumbai



Olivier Lafon
Unite de Catalyse et de Chimie du Solide (UCCS)
CNRS UMR 8181, Université de Lille
Villeneuve d'Ascq Cedex

Objectives

- Synthesis and characterization of fibrous nanosilica (KCC-1) with various textural properties by tuning the reaction time and temperature
- Development of novel multidimensional (DNP)-NMR techniques to probe internuclear proximities and connectivities in nanomaterials
- New insights into the DNP mechanisms (transfer depth, radical location) combining DNP-NMR, conventional NMR and EPR spectroscopy
- Surface modification of KCC-1 by nitridation and study of various active sites generated on its surface by NMR and DNP enhanced NMR and Probing interactions between the surface sites of nitridated KCC-1 and reagents or intermediates for chemical reactions catalyzed by nitridated KCC-1

Life & Health Sciences

DECIPHERING THE ROLE OF MYCOBACTERIUM TUBERCULOSIS SERINE/THREONINE PROTEIN PHOSPHATASE PstP

Principal Collaborators



Vinay Kumar Nandicoori
National Institute of Immunology
New Delhi



Virginie Molle
CNRS UMR5235- DIMNP (Dynamique des Interactions
Membranaires Normales et Pathologiques)
Universite Montpellier II, Montpellier

Objectives

- Generation of conditional gene replacement mutant of *M. tuberculosis* serine/threonine phosphatase PstP
- Deciphering the function of PstP using ΔpstP mutant and investigating its impact on phosphorylation status of protein kinases PknA, PknB and some of their substrates
- Global phosphoproteomic approach to identify novel targets for PstP
- Validation of the targets and determination of biological outcome of dephosphorylation
- Mouse infection studies to determine the role of PstP in mediating pathogen survival in the host

Project No. 5303-1

Apr. 2015 to Apr. 2018

Background

M. tuberculosis encodes for 11 serine/threonine protein kinases, one tyrosine kinase (PtkA), one serine/threonine phosphatase (PstP) and two tyrosine phosphatases (PtpA, PtpB). All the phosphatases have been biochemically characterized and the structures have been determined. PstP dephosphorylates PknA and PknB and its activity is regulated by phosphorylation. In this project, it is aimed to comprehensively investigate the role played by the sole serine/threonine protein phosphatase PstP and to generate conditional gene deletion mutant of PstP in *M. smegmatis* and *M. tuberculosis*. The mutants generated would be used to delineate its impact on phosphorylation status of protein kinases PknA, PknB and some of their substrates. The project proposes to investigate the role of PstP in the virulence of *M. tuberculosis* in mouse models, and perform phosphoproteomic profiling of *M. tuberculosis* and pstP mutant to identify novel targets of PstP.

Life & Health Sciences

ORIGINAL BIOCOMPATIBLE PHOSPHORUS DENDRIMERS AS A NEW STRATEGY TO TACKLE PULMONARY TUBERCULOSIS

Principal Collaborators



Kishore K Srivastva
AcSIR
CSIR-Central Drug Research Institute
Lucknow



Anne-Marie Caminade
Laboratoire de Chimie de Coordination du CNRS
Délégation Midi-Pyrenees
Toulouse

Objectives

- To deliver new anti-TB compounds to alveolar macrophages using original biocompatible phosphorus dendrimers (PDnd) based on targeted strategy, in order to find new anti TB compounds with good PK/PD profiles
- To develop the new phosphorus dendrimers against TB as molecular image-guided theranostic strategy for personalized medicine
- To develop new active compounds against TBs conjugated/encapsulated/complexed with bio-active phosphorus dendrimers

Project No. 5303-2

Sept. 2015 to Sept. 2018

Background

Dendrimers are nearly perfect tunable monodisperse macromolecules with a regular and highly branched three-dimensional architecture, and can be used as nanocarriers or as bioactive macromolecules active per se. Drugs can be either encapsulated into their void spaces or conjugated (prodrug approach) with cleavable covalent attachments on the functionalized surfaces by the introduction of specific chemical moieties. The needs of newly developed antitubercular agents are required for the control of tuberculosis (TB) in the present time. The emergence of multidrug-resistant and extensively drug resistant strains has encouraged the researchers to intensify the efforts to discover novel antitubercular drugs. The aim of this project is selectively to deliver new anti-TB compounds to alveolar macrophages using original biocompatible phosphorus dendrimers based on targeted strategy, in order to find new anti TB compounds with good PK/PD profiles. The goal is to develop these nanodevices as molecular image-guided theranostic strategy for TB personalized medicine.

Pure & Applied Physics

THEORETICAL STUDIES ON ULTRA-COLD DIPOLAR GASES

Project No. 5304-1

May 2015 to May 2018

Background

Ultra-cold atoms, the atoms are laser-cooled to temperatures of the order of micro or Nano Kelvins. In the last two decades it emerged as an interdisciplinary field studying problems from different aspects of physics such as various phenomena in fluids, high energy physics, electromagnetism, nonlinear, atomic, quantum computation/information, quantum optics etc. In particular, dipolar gases emerged as a key system for many such studies. The dipole-dipole interactions can be either electric or magnetic in nature for e.g. due to the spin of the valence electron in an atom (magnetic dipole), or induced electric dipole moment in highly excited Rydberg atoms or polar molecules. Recent experimental achievements of Bose-Einstein condensates (BECs) of Chromium (2005 Stuttgart, 2007 Paris), Erbium (2012, Innsbruck) and Dysprosium (2011, Stanford) being the land marks in this field and, in addition, molecular BECs and ultra cold Rydberg atoms have been realized in labs, which will pave a route to highly dipolar systems. The project explores various theoretical aspects, in particular, the microscopic properties of different dipolar systems and the associated novel phenomena/applications within the current experimental feasibilities.

Principal Collaborators



Rejish Nath
Indian Institute of Science
Education and Research
Pune



Paolo Pedri
Laboratoire de Physique des Lasers -CNRS - UMR7538
Université Paris 13 - Institut Galilée - 99
Villetaneuse

Objectives

- To explore the microscopic (atomic) properties of atomic dipolar gases, especially for Rydberg atoms, with and without the presence of external fields, and the long-term promise is to address exotic many body quantum phenomena by making use of the microscopic properties, in general associated with dipole-dipole interactions
- To study non-local nonlinear effects focused on weakly interacting regime, in which a dipolar Bose-Einstein condensate (BEC) is realized in harmonic traps
- To study on strongly correlated regime, where dipolar gases are loaded in optical lattices, can be used as quantum simulators for condensed matter problems including frustrated magnetism

Pure & Applied Physics

SYMMETRIES AND DYNAMICS: WORLD SHEET AND SPACETIME

Project No. 5304-2

Jun. 2015 to Jun. 2018

Background

Quantum consistency of string theory leads to a prediction that space-time is ten-dimensional. However, to relate the laws of particle physics in our four-dimensional world, six of the dimensions ought to be in the form of a compact space, or more precisely, an 'internal' conformal field theory. The microscopic details of this internal theory affect physics in four dimensions. One of the most interesting recent developments is that the internal theory may be non-geometric while still reproducing, on macroscopic scales, familiar particle physics in a four-dimensional world. However, our understanding of these non-geometric objects remains rather limited. The proposed collaboration aims at understanding such generalized-geometric and non-geometric objects, their mathematical structure and physical implications, using modern mathematical tools in the spacetime as well as world-sheet approach.

Principal Collaborators



Debashis Ghoshal
Jawaharlal Nehru University
New Delhi



Ruben Minasian
Institut de Physique Théorique
CEA - Saclay
Villetaneuse

Objectives

- To study generalised-geometric and non geometric objects, their mathematical structure and phenomenological implications, with emphasis on the quantum theory on both the space-time and the world-sheet
- To study discrete structures on the world-sheet and try to connect them to the continuum description based on world sheet approach

Pure & Applied Physics

QUANTUM TRANSPORT IN 2D VAN DER WAALS HETEROSTRUCTURES BASED ON GRAPHENE AND BORON NITRIDE

Principal Collaborators



Aveek Bid
Indian Institute of Science
Bangalore



Vincent Bouchiat
NEEL, CNRS-Grenoble
Grenoble

Objectives

- Fabricate layered heterostructures by stacking graphene (single or bilayer) with other layered materials, such as boron nitride (BN), to achieve a new class of composite materials
- Study quantum transport in high mobility graphene/BN heterostructures and interplay of quantum Hall Effect and superconductivity in high mobility graphene/BN heterostructures
- Investigate the ground state of charge-neutral modes in Fractional Quantum Hall (FQH) states

Project No. 5304-3

Apr. 2015 to Apr. 2018

Background

It is proposed a highly entangled joint- research program centered on the production and study of quantum electron transport properties of Graphene devices for which the carbon monolayer is encapsulated by Van-der-Waals interactions in between two layers of hexagonal Boronn Nitride, side-contacted with lateral electrodes and gated with set of top electrodes. These sandwiches allow to prepare 2D electron/hole gases with very long mean free paths and high electronic mobilities while top electrode deposited over the sandwich allow to shape the gas and create quantum point contacts, quantum dots and tunnel barriers. One aim is to study the interplay of superconductivity and quantum Hall effect in high mobility devices. It is proposed to study the phase and charge of the quasiparticles in these hybrid devices using Shot noise and electronic interference (Fabry- Perot and Mach-Zehnder) measurements also.

Pure & Applied Chemistry

AXIALLY CHIRAL BIARYLS FROM C-H ACTIVATION & RADICALS

Principal Collaborators



K. Rajender Reddy
CSIR- Indian Institute of Chemical Technology
Hyderabad



Françoise Colobert
University of Strasbourg/UMR 7509 CNRS
25 Rue Becquerel 67087
Strasbourg Cedex 2

Objectives

- To design new strategies to build-up axially chiral biaryls. Proposed work
- Synthesis of axially chiral biaryl scaffolds via Pd-catalyzed direct functionalization of pro-axially chiral biaryls
 - Stereoselective construction of axially chiral biaryl scaffolds via C-H activation/radical arylation

Project No. 5305-1

Jun. 2015 to Jun. 2018

Background

The aim of this project is the development of unprecedented stereoselective oxidative cross couplings based on a merge of a C-H activation and a radical chemistry. Such oxidative couplings of two non prefunctionalized coupling partners should enable to build-up high value added chiral scaffolds, such as axially chiral biaryls, in a straight forward way and under relatively mild reaction conditions. In order to achieve such ambitious goal two different approaches will be investigated: direct functionalization of prochiral biaryl scaffolds with a radical partner and direct radical arylation of phenyl derivatives bearing a chiral directing group. Such project tends, via the development of unprecedented coupling reactions, to bring promising and atom-economic solutions to organic chemistry, to investigate unprecedented fundamental transformations enabling chiral induction and therefore to design new handful approaches towards the synthesis of axially chiral skeletons.

Earth & Planetary Sciences

ADVANCED TIME-DOMAIN INTEGRATION SCHEMES FOR THE SIMULATION OF EARTH AND PLANETARY CORE DYNAMIC

Project No. 5307-1

Sept. 2015 to Sept. 2018

Background

Over the past two decades, our understanding of Earth and planetary core dynamics, and magnetic field generation within planetary interiors, has greatly benefited from numerical simulations. The temporal discretization used in these simulations has surprisingly received little attention. However, if one is interested in the long-term behaviour of planetary cores and magnetic fields, an efficient and accurate time scheme is in order. The purpose of the present research project is to implement such an efficient scheme. The project comprises two stages: the first stage consists of the implementation of a high-order time integrator capable of treating rotational effects implicitly. The second stage aims at placing that time integrator at the heart of the so-called parareal algorithm. This novel method enables domain decomposition to be carried out in the time domain, in addition to the spatial domain. It has yet to be applied in a planetary core dynamics setting.

Principal Collaborators



Binod Sreenivasan
Indian Institute of Science
Bangalore



Alexandre Fournier
Institut de physique du globe de paris (IPGP)
Paris

Objectives

- To design, implement, and validate novel time schemes for the numerical modelling of the dynamics of Earth and Planetary cores
- To initiate and lead an international benchmark initiative whose goal will be to better assess the efficacy of time schemes used among the community

Materials Science

MAGNETISM OF SELF-ORGANIZED STRUCTURES AT SURFACES

Project No. 5308-1

Jul. 2015 to Jul. 2018

Background

It is proposed to work both experimentally and theoretically on the magnetism of complex self-organized structures made out of surface bimetallic alloys and ferromagnetic/organic interfaces. Mainly two major issues will be addressed in magnetism, which are the increase of Magnetic Anisotropy Energy and Spin Polarization at the atomic scale. It is expected that the interaction between the groups, begun in a preceding contract focused on new structures at surfaces, to continue to be effective in this new direction, i.e., to address the questions on the magnetic properties at surfaces. The synergy between *ab initio* calculations performed in Bangalore, and magneto-optical Kerr effect (MOKE) and Spin Polarized Scanning Tunneling Microscopy (SP-STM) experiments done in Paris, should lead to important results on these topics.

Principal Collaborators



Shobhana Narasimhan
Jawaharlal Nehru Centre for
Advanced Scientific Research
Bangalore



Sylvie Rousset
UMR CNRS 7162
Université Paris Diderot – Paris 7
Paris

Objectives

- To understand fundamental parameters in magnetic materials, such as magnetic anisotropy energy and spin polarization
- To measure the magnetic properties of new surface alloys using magneto-optical Kerr effect
 - To calculate the magnetic properties, such as the magnetic structure, and magnetic anisotropy energies, of the surface alloys
 - To study the interplay between the magnetic properties of the ferromagnetic electrode and the spin polarization of the molecular layer in order to better understand the key parameters for an efficient molecular spin polarization

Biotechnology

A COMPARATIVE SYSTEMS BIOLOGY APPROACH FOR UNDERSTANDING DESSICATION TOLERANCE IN FORAGE GRASSES AND *SELAGINELLA* SPS

Principal Collaborators



R.G. Sharathchandra

Centre for Bioinformatics
Department of Studies and Research In
Environmental Science Tumkur University
Tumkur



Azeddine Driouich

IRIB-PRIMACEN-IBISA
Université de Rouen
Mont- Saint Aignan

Project No. 5300-B1

Jul. 2015 to Jul. 2018

Background

Water supplies for agriculture are a major factor in limiting crop and livestock production. The project proposes to undertake comparative systems biology based evaluation of a new selection of grass species that have the ability to thrive under air dried conditions, for fresh and dry biomass production. For this purpose grasses of genera *Eragrostiella*, *Oropetium* and *Triopogon* that can survive total drying of its vegetative tissues, and produce sufficient quantity of (biomass) under three different water stress regimes will be used. These grasses will be compared with mosses like *Selaginella* that incorporates a constitutive mechanism of desiccation tolerance. Also, proven models of Desiccation tolerance (DT) and sensitivity (DS) like *Craterostigma/Myrothamnus* will be included for baseline comparison of DT/DS *Selaginella*, a vascular plant with true roots and shoots, occupy diverse habitats including arctic, temperate, tropical and semi-arid environments. Several members of the *Selaginella* genus have evolved desiccation tolerance (DT) and several species like *kraussiana*, *bryopteris* and *martensii* from sub-tropical forests of India have been tested its drought tolerance potential. A comparative systems biology approach will be used to understand the mechanism of desiccation tolerance, and to determine at which level of control the changes are affected.

Objectives

- Development of appropriate cultivation methods, physiological baseline studies and collecting/harvesting resurrection grasses and *Selaginella* sps
- Performing untargeted proteomic and metabolomic analyses of the resurrection plants selected and identified
- Implementing a range of wall profiling, cell wall proteomics and metabolomics analyses on the resurrection plants selected and identified
- Integration of -omics and wall profiling datasets, confirmation with gene expression studies and the use of multi variate, statistical and bioinformatic tools to determine potentially high impact genes

Pure & Applied Mathematics

SUMS OF INTEGERS: FOURIER, COMBINATORICS, COMPUTATION

Principal Collaborators



R. Balasubramanian

The Institute of Mathematical Sciences
Chennai



Jean-Marc Deshouillers

Institut Mathématique de Bordeaux
Université de Bordeaux-CNRS
Bordeaux

Project No. 5401-1

Jan. 2016 to Dec. 2018

Background

Additive number theory, approached by the tools of harmonic analysis and combinatorics, is a "hot" topic, named as Additive Combinatorics. The aim of the project is to put together the efforts of nine Indian and French researchers, who have proved their expertise in this and connected fields, and who have (almost all of them) already some Indo-French joint publications. A further aspect we wish to develop is the computational approach which seems very promising for at least two of the four themes presented in the project. The itemized presentation by "themes" should not hide the will of all the participants to be involved in all the themes.

Objectives

- Theme 1. An inverse additive problem: sum-free sets. Let p be a prime number and A a subset of $\mathbb{Z}/p\mathbb{Z}$ such that $A+A$ and A are disjoint. Characterize A
- Theme 2. Large subsets of integer sequences. How they retain the additive properties of the initial sequence
- Theme 3. Expander functions. Let F a finite field. A binary expander is a function $f(x,y)$ such that if A is a subset in F then $|F(A,A)|$ is considerably bigger than $|A|$. Known explicit expanders can be rewritten under the form $a(x)b(y)+c(x)$
- Theme 4. Functions « sum of digits

Life & Health Sciences

PATHOGENIC *ASPERGILLUS*: INTERACTION WITH INNATE IMMUNE CELLS

Project No. 5403-1

Jan. 2016 to Dec. 2018

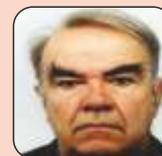
Background

This project aims at comparing the pathogenesis of two *Aspergillus* (*A. fumigatus* and *A. flavus*) which are the major aerial fungal pathogens in India and France. *Aspergillus fumigatus* causes systemic infections worldwide, particularly in the immunocompromised individuals/patients, which are often fatal; whereas *A. flavus* causes superficial eye/corneal infection which is a major cause of keratitis in tropical part of the world. In this collaborative project, it is proposed to use combined expertise to (i) unravel the pathogenic components and their role in modulating host immune responses during infection and (ii) in identifying common and uncommon aspects of two pathogens while establishing their pathogenicity, which might lead us to the development of universal or differential therapeutic strategies against these two fungal infections. The study will be focused on the fungal cell wall polysaccharides and the cell surface/secreted proteins as they are the first fungal components interacting with the host.

Principal Collaborators



Lalitha Prajna
Aravind Medical Research Foundation
Aravind Eye Hospital & PG Institute
of Ophthalmology
Madurai



Jean-Paul Latgé
Institut Pasteur
Paris

Objectives

- Analyzing the differential interactions of two *Aspergillus*, *A. fumigatus* and *A. flavus*, with their host in the context of their specific pathologies
- Understanding the phagocytic responses toward *Aspergillus* morphotypes (dormant and germinating conidia)
- Identifying and characterizing the fungal cell surface components which activate or repress the host immune response
- Studying in depth the immunogenic function of the core cell wall fungal polysaccharides uptake by phagocytes, surface receptor identification and degradation
- Recognizing the components of the phagolysosome involved in the intracellular recognition of the fungus

Pure and Applied Physics

LORIC: LONG-RANGE INTERACTIONS IN ULTRA COLD GASES

Project No. 5404-1

Mar. 2016 to Feb. 2019

Background

This project combined experimental and theoretical approaches that are expected to shed light on the fascinating properties of quantum gases with long-range interactions. The consortium will cover this field in a very broad way : at LPL, studies focus on manybody physics of bosons or fermions in optical lattices with $1/r^3$ interactions ; at RRI, two-body and few-body long-range interactions will be studied, with a possibility to choose the exact power-law of the interaction $1/r^n$. At LAC, new strategies to produce dipolar or ionic molecules will be sought, including (experimentally) electronic Attachment, deceleration and trapping, and (theoretically) photo-association to create neutral molecules and molecular ions. A strong collaboration between the groups would therefore create a research platform on long-range interacting systems which has probably no equivalent in the world.

Principal Collaborators



Sadiqali Abbas Rangwala
Light and Matter Physics Division
Raman Research Institute
Bangalore



Olivier Dulieu
Laboratoire Aimé Cotton, CNRS
Bat 505, Université Paris-Sud
91400 Orsay

Objectives

- Many-body physics in ultracold polar gases : quantum magnetism of dipolar bosonic and fermionic chromium atoms due to direct spin-spin coupling arising from dipolar interactions magnetic phases of chromium atoms in the 2D geometry (where dipolar interactions may be tuned) K-Rb molecules in an optical lattice
- Production of cold molecules and cold molecular ions : radiative association of molecular ions from ion-atom mixtures creation and detection of an interacting gas of homonuclear and hetero-nuclear (with a dipole moment) molecules
- Cooling molecules : innovative deceleration method for polar molecules, based on electron attachment, deceleration and trapping

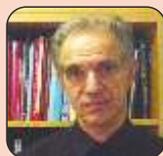
Pure and Applied Physics

GLIMPSES OF NEW PHYSICS

Principal Collaborators



Gautam Bhattacharyya
Saha Institute of Nuclear Physics (SINP)
Kolkata



Emilian Dudas
Centre de Physique Théorique
Ecole Polytechnique
Palaiseau

Objectives

The three main directions in which the extensions of the Standard Model are proposed are: (a) Higgs and Hierarchy Problem (b) Dark Matter and (c) Flavour Physics which includes neutrino masses and mixing

- Higgs and Hierarchy Problem :
Low-energy Supersymmetry and Extra dimensions are theories which have been proposed, which are motivated from various theoretical ideas. The second Run of LHC might throw light on this important matter
- Dark Matter: To classify the different types of signals (from low keV energies to PeV events) and embed the observations within ultraviolet frame works (super symmetry or GUT like models for instance)
- Flavour Physics which includes neutrino masses and mixing:
To redefine consequences of the various models in low-energy experiments in view of the present and forthcoming data

Pure and Applied Chemistry

H₂ EVOLUTION: CHEAP CATALYSTS FOR NOBLE TASK

Principal Collaborators



Abhishek Dey
Indian Association for the
Cultivation of Science
Kolkata



Vincent Artero
Laboratoire de Chimie et Biologie des Métaux
CEA-Grenoble
Grenoble

Objectives

- Investigation of the H₂ evolution mechanism catalyzed by bio-inspired compounds
- Enhancing catalytic performances for H₂ evolution

Project No. 5404-2

Feb. 2016 to Jan. 2019

Background

One of the important questions in the field of high energy physics is the following:

There is a strong indirect evidence that there should be new physics beyond standard model. This evidence is through the discovery of neutrino masses and oscillations, thenon Standard Model (SM) nature of dark matter particles etc. On the other hand, at the same time, the actual structure of new physics is lacking any direct evidence. Searches at colliders like LHC and B-factories have not yielded yet any positive results. In high precision experiments like rare decays of mesons or electric and magnetic moments of leptons and atoms or nuclei there is also no evidence of new physics so far. There is however a hint of new physics in the measurement in the muon anomalous magnetic moment, which needs further confirmation. The recent discovery of the Higgs Boson has also opened several questions: whether the Higgs is composite or elementary; whether it has any further cousins, at what scale the Higgs potential is stable etc. In the present project, it is proposed to address these questions. More concretely, where is the new physics, what is its structure and where can we find it.

Project No. 5405-1

Mar. 2016 to Feb. 2019

Background

The two applicant groups have already reported a set of biomimetic Fe-Fe, Ni-Fe, Ni-Mn and Mo based efficient H₂ producing catalyst with potential to replace noble metals in water-splitting electrolyzers. This project has two major goals. First, the mechanism of these HER catalysts will be studied in more details, both under homogeneous and heterogeneous conditions, using complementary electrochemical, analytical and spectroscopic (Resonance Raman, FTIR, XPS, EPR) methods available in both labs. Second, novel HER catalysts will be designed so as to improve their kinetics, allow for reactivity from water in the presence of O₂. Modifications include ligand variation in the Fe-Fe and Ni-Fe/Ni-Mn series, incorporation of pendant proton relays as well as incorporation of transition metal ions as dopant in the layered ammonium thiomolybdate material or development of similar tungsten-based materials.

Materials Science

UNDERSTANDING MECHANICAL SIZE EFFECTS IN METALLIC MICRO-WIRES: SYNERGY BETWEEN EXPERIMENTS AND SIMULATION

Project No. 5408-1

Nov. 2015 to Oct. 2018

Background

The project aims at a comprehensive investigation on size effects in microwires, involving (a) microstructural control during the wire drawing process, (b) conventional mechanical testing, (c) *in-situ* mechanical testing in an SEM, (d) *in-situ* testing in synchrotron, (e) relevant microstructural studies including texture evolution, and (f) finite element modeling. The proposed program utilizes optimally the complementary expertise and facilities available with the investigators in India and France. Specifically, the role of grain size, dislocation density and texture on strengthening in microwires, together with any associated size effects will be evaluated. Of particular interest is shear banding that has been observed recently in Ni microwires, which may provide an additional contribution to strengthening by enhancing the geometrically necessary dislocation density. Contributions to the general understanding of size effect on materials mechanical properties are also anticipated with this project.

Principal Collaborators



Atul Chokshi
Indian Institute of Science
Bangalore



Ludovic Thilly
Institut Pprime (UPR 3346
CNRS-Université de Poitiers-ENSMA)
Futuroscope

Objectives

- Micro-wires fabrication with controlled microstructure and texture
- Microstructural characterization by EBSD, XRD and TEM
- In-situ mechanical testing under synchrotron radiation: elastic-plastic transition, evolution of dislocation density and possible modification in crystallographic texture
- Development of a representative microstructure having a surface matching with experimental EBSD map, and the distribution of grains in the volume being statistically representative in term of grain shape (elongated grains), distribution of size, and distribution of crystallographic orientations
- Finite element modelling of the micro-wires behavior, taking into account microstructural and size effects
- Understanding size effects on strength in polycrystalline micro-wires and processing-microstructure-property correlation



5. Brief Reports of Research Projects

B. High Impact Scientific Research Network Programme

High Impact Scientific Research Network Programme

CEFIPRA has been traditionally associated with bridging of individual scientists of two countries in collaborative mode. A rich plethora of scientists and scientific group are well networked. In 2014, after 27 years of inception of the Centre, in order to harvest the strength of the network and as per the directive of the 27th meeting of the Governing Body held in March 2014, CEFIPRA launched first call on High Impact Scientific Research Network Programme in all the areas of interest in Science & Technology between India and France. The following two proposals were selected for support under the programme:

INTERNATIONAL STUDY ON ATYPICAL HEMOLYTIC UREMIC SYNDROME

Project No. Network-1 AHUS

Apr. 2016 to Mar. 2019

Principal Collaborators



Aditi Sinha
Department of Pediatrics,
All India Institute of
Medical Sciences



Amit Dinda
Department of Pathology
All India Institute of
Medical Sciences



Uma Kanga
Scientist, Transplant
Immunology &
Immunogenetics; AIIMS



Satyajit Rath
Scientist, Department of
Immunobiology; E
NII, New Delhi

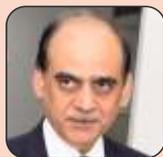
Pankaj Hari
Department of Pediatrics
All India Institute of
Medical Sciences



Mitali Mukherjee
Senior Principal Scientist;
Institute of Genomics &
Integrative Biology, New Delhi



Debasis Dash
Principal Scientist;
Institute of Genomics &
Integrative Biology, New Delhi



Arvind Bagga
All India Institute of
Medical Sciences



Marie-Agnès DRAGON-DUREY
INSERM UMRS 1138,
team 10 "Complement
and diseases"

Regis Daniel
Laboratoire Analyse et
Modélisation pour la Biologie
et l'Environnement at Université
Evry-Val-d'Essonne, Evry

Ali Si Mohammed
PH dans le service
Laboratoire de
Serologie-Virologie Dijon

Network

French laboratories

PH dans le service Laboratoire de Serologie-Virologie Dijon and Laboratoire Analyse et Modélisation pour la Biologie et l'Environnement at Université Evry-Val-d'Essonne, Evry.

Indian laboratories

All India Institute of Medical Sciences, National Institute of Immunology and Institute of Genomics & Integrative Biology, N.Delhi.

Summary

A clinical research on Hemolytic Uremic Syndrome (HUS), one of the commonest causes of acute kidney injury in children, is a multifactorial illness, determined by environmental factors that damage the endothelium and intrinsic factors that favor disease progression. Both centers in Paris and New Delhi are involved. It is proposed to establish a network of scientists and clinical researchers in the two countries involved in a clinical research on Hemolytic Uremic Syndrome for compiling and exchanging clinical and biological data of French and Indian patients that would enable phenotyping and follow up data of the cohort, epidemiological analysis and identify triggers of the disease.

On the medium term, the collaborative network shall improve our understanding of the pathogenesis of this disease and the reasons for variable prevalence of the disease. A precise knowledge of the etiology and outcomes of HUS is necessary to enable an understanding of the mechanisms of disease and impact of therapies, as well as improve outcomes by timely management. There is limited knowledge of underlying complement abnormalities among Indian patients with HUS. Tests for screening of complement regulatory proteins are only partially available. A comprehensive evaluation of complement regulatory proteins and documentation of clinical features and outcomes in relation to therapies are essential initial steps towards determining the etiology, pathogenesis and outcomes of HUS. The network shall enable complementary research on the pathogenesis and functional relevance of anti-CFH antibodies in patients with atypical HUS, and improved understanding of this rare.

INDO-FRENCH HIGH ENERGY PHYSICS NETWORK

Project No. Network-2 INFRE-HEPNET

Jan. 2016 to Dec. 2018

Principal Collaborators



Sudhir Kumar Vempati
Centre for High Energy Physics
Indian Institute of Science
Bangalore



Biswarup Mukhopadhyaya
HRI
Allahabad



Gautam Bhattacharya
SahaInst
Kolkata



Sourendu Gupta
TIFR
Mumbai



Fawzi Boudjema
LAPTh
CNRS, Chemin de Bellevue
Annecy-le-Vieux



Aldo Deandrea
IPNLyon



Emilian Dudas
SaclayLPTO



Fawzi Boudjema
LAPTh



Jean-Yves Ollitrault
IPhT
Saclay

Network

French laboratories

LAPTh - Annecy, IPhT - CEA-Saclay, LPT- Orsay, CPhT-Polytechnique, LPSC- Grenoble and IPN Lyon from France

Indian laboratories

Indian Institute of Science (IISc)-including the Indian Institute of Mathematical Sciences (IIMSc)-, Tata Institute of Fundamental Research (TIFR)-including Indian Institute of Science Education and Research-Pune (IISER-Pune), Harishchandra Research Institute (HRI) -including Delhi University- , Saha Institute of Nuclear Physics (SINP)-including Indian Institute of Science Education and Research-Kolkata (IISER-Kolkata) and the Indian Association for the Cultivation of Science (IACS), Kolkata from India.

Summary

This NETWORK involves a large fraction of the best experts in the theory, phenomenology and experimental high energy physics in both countries. This first group of laboratories could, in the future, open up to other laboratories in France and India.

The success of the Large Hadron Collider (LHC) has been as admirable as the triumph of the Standard Model(SM), of the fundamental interactions. The SM can now be elevated to the status of a fully-fledged theory. Indeed, the 7-8TeV runs of the LHC confirmed the existence of what looks like the Higgs particle, the last missing entry of the theory and a cornerstone for the concomitant mechanism of electroweak symmetry breaking. This crowning is also deserved because the theory has been for some time practically on par with the theory of quantum electrodynamics in allowing for very precise predictions to be made. Yet, the fundamental dilemma with the formulation of the symmetry breaking mechanism and the existence of an elementary scalar particle, the Higgs, is even more persistent now. This is related to the so-called naturalness problem which is made more acute if one admits that the SM-theory is only part of a more complete theory. Dark Matter, for which there is overwhelming evidence, is one example of New Physics that should be described by this more complete theory. With present data, the LHC has not provided any evidence for New Physics, either through the discovery of new particles or through discrepancies with the SM-theory predictions.

The project will underline specific directions where there is added value and pooling of resources and expertise will be an advantage.



5. Brief Reports of Research Projects

C. Industry Academia Research & Development Programme

Completed Projects

SELECTIVE OXIDATIONS WITH HYDROGEN PEROXIDE: DEVELOPMENT OF NEW CATALYST & PROCESS CONDITIONS

Domain: Chemistry

Jan. 2013 to Dec. 2015

Background

Hydrogen peroxide is a well-known green oxidant that produces water and oxygen as byproducts. It is therefore a very interesting oxidant for environmentally friendly industrial processes. CSIR-NCL has good knowledge of activation catalysts for hydrogen peroxide. ARKEMA skills oxidation reactions are widely recognized as it is a producer and distributor of H₂O₂. UCCS is renowned for its competences in catalysis and spectroscopic characterization of catalysts. It works on the oxidation of organic molecules. Considering this, the activation of the green oxidant hydrogen peroxide and its use as a reagent in reactions with biomass has been proposed. Different selective oxidations with hydrogen peroxide are studied based on the various molybdenum complexes developed by the NCL.

Objectives

- Development of new catalysts and process conditions for selective oxidation with hydrogen peroxide
- Promotion of oxidation processes using the green oxidant hydrogen peroxide, accessible to a large number of end-users

Knowledge Generated / Products Developed

- 14 catalysts samples prepared
- Catalysts were characterized directly after synthesis showing the presence of the ligands
- Several catalysts were characterized by Raman, 95Mo NMR and UV-Visible spectroscopy using high and low concentration of Mo species in peroxide solution
- Oxidation of veratryl alcohol carried out as model reaction for delignification in paper and pulp industry
- Optimised parameters showed promising oxidation activity in neutral medium compared to conventional Kraft process which needs highly basic medium
- High efficiency of the catalyst for delignification of pulp without sacrificing degree of polymerisation in neutral conditions
- Successful catalyst recycling

Indian Collaborators



Shubhangi Umbarkar
National Chemical Laboratory
Pune



Markus Brandhorst
Arkema Centre de Recherche
Rhône-Alpes

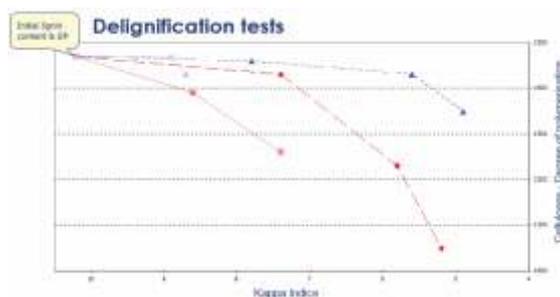


Jean-Luc Dubois
Arkema Centre de Recherche
Rhône-Alpes



Edmond Payen
Université Lille 1
Lille

French Collaborators



Catalytic delignification tests with H₂O₂ under different conditions

Completed Projects

FINANCIAL-INCLUSION BASED UPON RURAL MOBIQUITOUS SERVICES TECHNOLOGICAL PLATFORM

Domain: Computer Science

Sept. 2012 to Jun., 2015

Background

Financial exclusion has been a major problem for India and other developing countries with most of the rural population excluded from banking and other financial services. In India, Government has taken major initiatives for 'Bottom of Pyramid' to use smartcards in the Rural Inclusion scenarios like FI (Financial Inclusion), PDS (Public Distribution System), RSBY (Rastriya Swasthya Bima Yojana – insurance scheme) and NREGA (National Rural Employment Guarantee Act). However success of such initiatives largely depends on the selected technology and presence of an integrated platform/ecosystem. At the same time, with all struggle Government is aggressively pursuing unique identification program (UIDAI) for citizen of India which is valid for his/her life. The unique identification program has a strong impact on the security and accountability of all services offered by Government and all other sectors like Banks, Private /Public organization. But, all of the noble initiatives are facing the following serious problems to be sustainable in future.



- 1) Implementations of the initiatives in silos
- 2) Right business model, technology and infrastructure to reach rural community
- 3) Lack of integrated common security and accountability infrastructure
- 4) Lack of adequate standards and ecosystem
- 5) Need of very high capital and operational cost

Objectives

The primary objective of FIRST Project is to develop a unified and integrated platform as well as to create/offer a sustainable ecosystem having variable business models with low-cost, secured services involving Banks, MNOs and other stakeholders to support rural initiatives in India. To demonstrate FI and PDS scenario using FIRST platform, which can be taken to next level in addressing the digital initiatives in India

Knowledge Generated / Products Developed

- **FIRST Platform - FIRST Service Integration Hub**

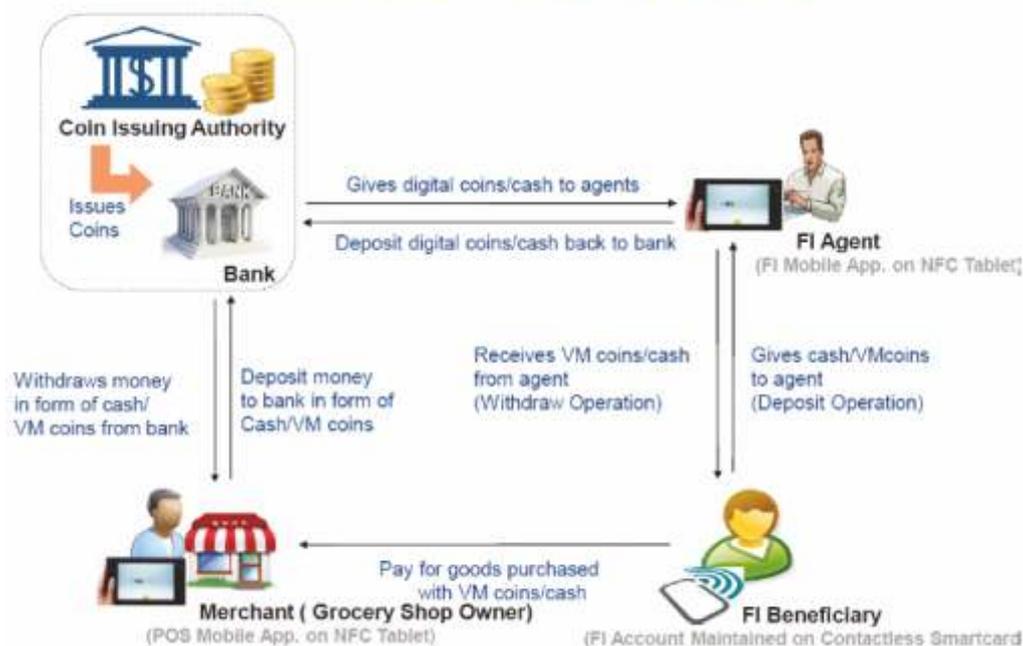
The FIRST platform and 'FIRST Service Integration Hub' will offer an integrated platform for easy plug-in of the rural inclusion based services like FI, PDS, NREGA, RSBY etc. thereby allowing faster, low-cost and convenient implementation of the Government initiatives



Rural Services (FI,RSBY,NAREGA,PDS etc) with Virtual Coins

Rural Services like Financial Inclusion with virtual coins offers multi-fold benefits to the rural population. Firstly, it offers easy banking services for the unbanked people and secondly it provides a small community money exchange ecosystem based on virtual coins eliminating the need of any physical cash. As part of the virtual coin integrated FI solution, Android mobile applications have been developed for bank agents, FI beneficiaries and merchants for coin exchange and other banking transactions.

Financial Inclusion with VM Coins



Indian Collaborators

C. E. Veni Madhavan
Indian Institute of Science
Bangalore

Sundeep Oberoi
Tata Consultancy Services
Mumbai

Debi Prasad Pati
Tata Consultancy Service
Kolkata



French Collaborators

Serge Miranda
Université de Nice
Sophia Antipolis

J. P. Tual
GEMALTO
Paris

Ongoing Projects

TILLING IN CUCURBITS: A NON-TRANSGENIC REVERSE GENETIC APPROACH FOR MUSKMELON CROP IMPROVEMENT

Domain: Agricultural Science

Mar. 2013 to Feb. 2015

Background

Experts predict that we will need to double food production in order to feed a global population projected to reach 9.7 billion by 2050, nearly 1.7 billion in India alone. Furthermore, it is forecast that India will overtake China as the world's most populous country by 2030. Food security is now threatened globally by climate change, increased demand, unstable production, post-harvest losses and volatile prices as well as an impending shortage in oil production due to declining reserves. It is, therefore, imperative for the country to begin work on adopting new technologies in agriculture for ensuring that its people have enough food to eat. In a recent 2016 report it has been shown that about maximum post-harvest losses occur in India for vegetable and fruits (16%) valued at Rs 40,811 crore (\$6 billion). Till date LSL melons are not commercialised in India unlike in France. However considering the losses incurred in the field, in transit and on storage, there are significant benefits of LSL trait in melons. Furthermore, this trait will also allow export of melons to the Middle East from India.



French Charentais melon



Production of EMS treated mutant population



LSL mutants (left) and Wild type (right). Penetrometer reading of mutant was 5 to 6.5 and wild type was 1.2. Higher score indicates LSL

Objectives

- Creation of EMS-mutagenized mutant collection from NSL Lines (NSL+BBIO)
- DNA extraction from 6000 M2 families (BBIO)
- Detection of mutants in the LSL (Long Shelf Life) gene (INRA)
- Phenotypic evaluation of mutants, Trait integration and commercial product development (NSL)

Knowledge Generated / Products Developed

- DNA extracted from EMS-mutagenised mutant collection (NSL+ BBIO)
- TILLING in LSL gene identified (INRA)
- TILLING mutant backcrossed to the wildtype and phenotyped for LSL
- LSL line identified (INRA, NSL)
- Commercial muskmelon hybrid for the Indian market with a longer shelf life, compared to other Indian origin varieties, is ongoing (NSL)

Indian Partners



Manash Chatterjee
Bench Bio Pvt. Ltd (BBIO)
Gujarat



Uday Singh
Namdhari Seeds Pvt. Ltd (NSL)
Bangalore

French Partner



Abdelhafid Bendahmane
Institut national de la recherche agronomique (INRA)
Paris

Ongoing Projects

ULTRASONIC SHEAR HORIZONTAL (SH) GUIDED WAVES GENERATED BY ELECTRO MAGNETIC ACOUSTIC TRANSDUCERS (EMAT) FOR THE INSPECTION OF BOND QUALITY IN AERO-SPACE COMPOSITE JOINTS

Domain: Aerospace

Apr. 2014 to Apr. 2017

Background

Light-weighting considerations have led to increased use of composites in aerospace components, with consequent rise in adhesively bonded structural joints. While there is much interest in guided waves for rapid inspection of large structures from single transducer location, in an immediately preceding project the PIs showed much promise for Shear Horizontal (SH) waves for inspection of bond quality. This project aims to evaluate the advantages of using SH guided waves and Electromagnetic Acoustic Transducers (EMATs) for characterization of structural bondings in aerospace components. Wave interactions with bond defects is sought to be understood first, in order to achieve a method to detect poor bonding. The next steps will be to adapt this method to practical composite bondings.

Objectives

- Understanding SH guided wave behaviour in composite lap joints
- Design EMAT sensors adapted for composite lap joint
- Obtain experimental result on metallic and composite lap joints

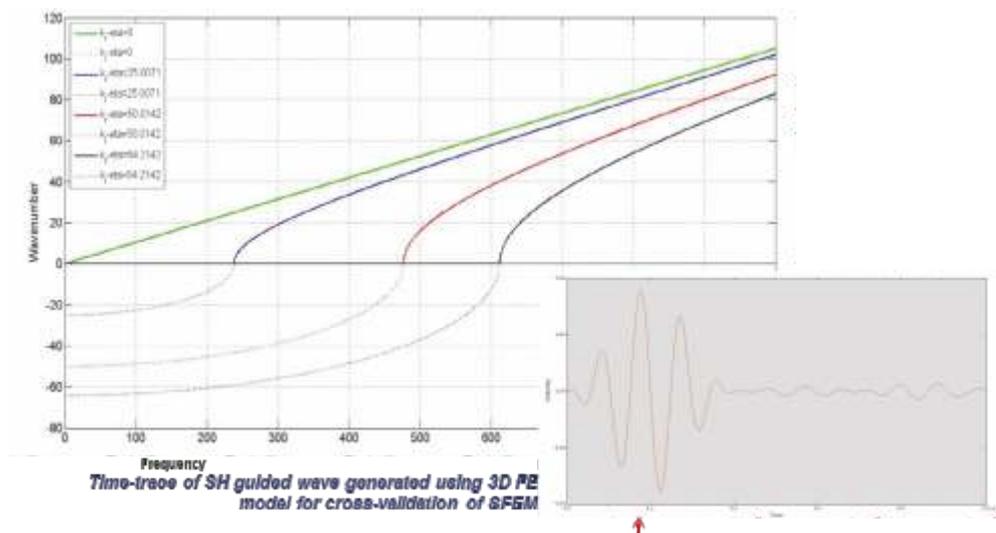
Knowledge Generated / Products Developed

Simulation of guided waves in single and Lap-joined metallic plate structures using Finite Element (FE) models

- FE simulation study of guided wave propagation in isotropic solids completed
- First simulation studies of Lamb and SH-guided wave interaction with epoxy adhesive layer in Al-Al lap joint completed
- Model dimensions and material properties as relevant to samples given by AIRBUS

Simulation of Lamb waves in single and Lap-joined plate structures using Spectral Finite Element (SFEM) and 3D Finite Element (FE) models

- Detailed literature survey and SFEM formulation for SH wave propagation in metallic structures
- Validation of SFEM results using conventional FEM ongoing: PhD student learning FE simulation for better coordination with IITM
- SFEM model formulation and validation for composite plate structures ongoing
- Metallic specimen samples manufactured; Reference / Double thickness / Not sanded / Polluted



Dispersion curves for SH guided waves in metal plates obtained using SFEM(IISC) IIC Airbus Safran Launchers France



Metallic specimen samples manufactured (Airbus)

Indian Partners



Krishnan Balasubramaniam
*Indian Institute of Technology Madras
Chennai*



Prabhu Rajagopal
*Indian Institute of Technology Madras
Chennai*



S. Gopalakrishnan
*Indian Institute of Science
Bangalore*



Sujatha Chakravarthy
*Dhvani Research &
Development Solutions Pvt Ltd
Taramani
Chennai*

French Partners



Michel Castaings
*Universite de Bordeaux
Talence*



Oudea Coumar
*Airbus Safran Launchers
Les Meureux*

Ongoing Projects

DEVICE-TO-DEVICE D2D COMMUNICATION FOR LTE ADVANCED CELLULAR NETWORKS

Domain: Telecommunication

Apr. 2015 to Apr. 2018

Background

Information-theoretic analysis of Device to Device (D2D) and cellular communications has recently gained considerable attention as it lays out the fundamental limits of D2D communications. A related body of literature aims at characterizing the fundamental limits of communications under the spectrum overlay model in cognitive radio communications. In this model, a primary transmitter non-causally shares its messages with a secondary transmitter, and, in return, the secondary transmitter ensures that its message causes no loss of rate to the primary transmitter. Such studies aim at characterizing the maximum data rates or capacity region that can be achieved over networks that employ D2D communication.

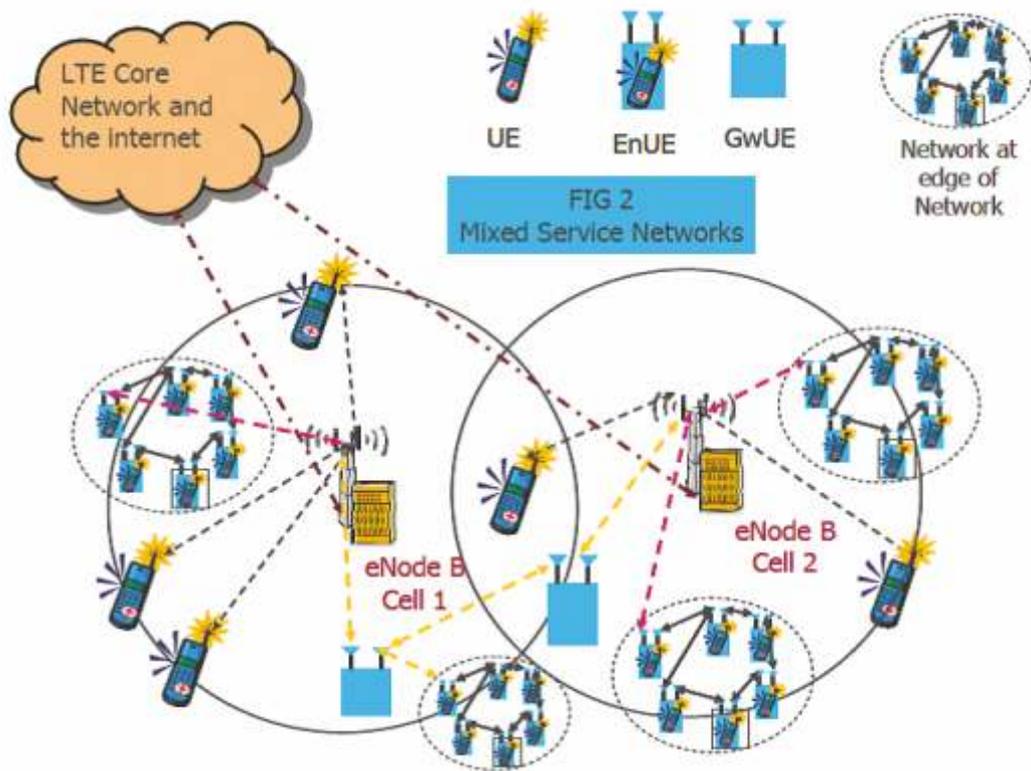
The Device to Device paradigm considered by both academia, industry and 3GPP standards to handle the next LTE evolution use cases, and lead to future novel wireless applications for proximity services, content sharing, distributive storage, multiparty gaming, monitoring and control of cyber physical systems. D2D changes the cellular architecture by allowing two devices to communicate directly when in proximity of each other. It also has the added advantage of being supported by control and coordination functions implemented by eNodeBs and the core network.

Objectives

- Design and performance evaluation of dynamic centralized and distributed opportunistic spectrum allocation and sharing mechanisms for D2D in LTE-Advanced networks
- Derive the fundamental achievable rates of D2D communications when the eNodeB is D2D-aware
- Design of signal processing algorithms to facilitate D2D communications, such as beam-forming vector design and fast spectrum sensing for intra-cell resource scheduling
- Develop algorithms for peer and link discovery protocols for D2D communication in LTE-Advanced, and evaluation of the signalling overhead vs. throughput trade-off
- Propose new versions of Mobile Ad-hoc Networks (MANET) protocols such as Optimized Link State Routing Protocol (OLSR) for D2D multi-hop communications
- Devise Relaying, Cooperation and self-organization strategies for heterogeneous networks using distributed computations over networks

Knowledge Generated / Products Developed

- Started developing online matching algorithms for both homogenous model (*no distinction between cellular and D2D nodes*) and heterogeneous model (*D2D nodes are only help providers and not help seekers*) that match a D2D user on its arrival with one of the cellular/D2D users that has not been matched before
- Pricing mechanism for D2D association developed that are truthful and have constant performance gap from the optimal
- Explored the joint mode-selection and power-allocation problem from a stochastic optimization perspective. Convergence results have been derived for the same
- Developed a reduced feedback cross-link interference statistics-aware adaptation algorithm (CLISAA) to facilitate throughput-optimal model selection, user scheduling, and rate adaptation in D2D networks without overwhelming uplink with D2D feedback information. Algorithms help base station to carry out these tasks despite having limited channel state knowledge about many links in a cell
- Inria & ALBLF Discussion and Exchange on industrial perspective /challenges according to NGMN/IETF/IEEE for Connectionless access protocols in IOT (D2D vertical Market use cases), commenced state of the art
- Devised and edge-caching framework for D2D communication utilizing stochastic sub-gradient algorithms. The paper, consisting of novel results and new simulations, has now been submitted to IEEE transactions



The schematic above presents the layout of a generic LTE network where the D2D communication capabilities are exploited in multiple configurations. Different elements of the network equipment namely eNodeB and the eNodeB controllers as well as different types of User Equipments (UE's) are shown

Indian Partners



Rahul Vaze
Tata Institute of Fundamental Research
Mumbai



Ketan Rajawat
Indian Institute of Technology
Kanpur



Neelesh B. Metha
Indian Institute of Science
Bangalore



Chandra R. Murthy
Indian Institute of Science
Bangalore

French Partners



Marceau Coupechoux
Institut Mines-Telecom
Telecom Paris Tech
Paris



Michele Wigger
Telecom Paris Tech
Paris



Amira Alloum
Alcatel Lucent Bell Labs France
(ALBLF)
Now: Nokia Bell Labs
Nozay



Cedric Adjih
Institut national de recherche
dédié aunumérique (Inria)
Pairs -Rocqencourt



Paul Muhlethaler
Institut national de recherche
dédié aunumérique (Inria)
Pairs -Rocqencourt

Ongoing Projects

INDIRA-B: INDICATORS OF RELIABILITY AND VARIABILITY OF BRT

Domain: Automobile

Jan. 2016 to Dec. 2018

Background

The sustainable development of cities depends on developing safe and low-carbon transport systems which provide access to the required goods, services and activities for all citizens. An efficient public transport system helps meet the mobility needs of a city, using fewer financial and energy resources, compared to private vehicle-oriented mobility. It also helps in improving the public health and well-being of inhabitants by reducing pollution and improving safety on roads.

Bus systems form the backbone of public transport system in Indian cities. Most Indian cities have low per capita incomes and vehicle ownership rates. As a result, usage of personal cars and two-wheelers is still prohibitively expensive for large sections of the society, who rely on public transport (Census 2012a). Modern bus systems require efficient management of bus operations, fleet management and serving the needs of bus commuters. This is based on analysing bus operation data and developing performance measures which can benefit the operators, policy makers and bus commuters. Therefore, the focus of the current project is to assess some of the existing well known quality-of-service indicators, and to develop new ones.

Objectives

- The objective is to assess some of the existing well known quality-of-service indicators, and to develop new ones
- To develop a computer-based research tool consisting of different modules which could be integrated into an operational platform for analysis and diagnosis of the quality of service of Bus Rapid Transit System (BRTS)/ bus systems lines in different operational use
- To design a bus fleet "supervision cockpit" for both operators and public transport authorities, and to set up the ClaireSiti platform on the Indian data (Delhi data)

Knowledge Generated / Products Developed

- Review of performance indicators
- Developing new indicators
- Exploratory analysis of AVL data and ETM data from 35 routes in Delhi
- Offline interface between the ClaireSITI platform and DIMTS data(sample routes)

Indian Partners



Geetam Tiwari
Indian Institute of Technology
Delhi

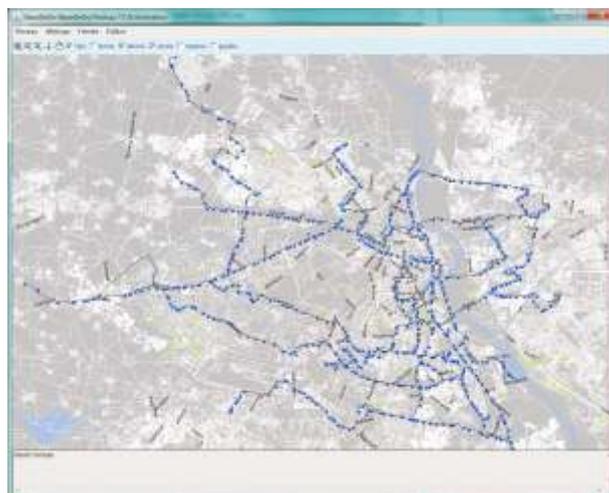


Tariq Mustafa
Delhi Integrated Multi-Modal
Transit System Ltd.
Delhi

French Partners



Neila Bhouri
GRETIA
COSYS I
FSTTAR
Marne la Vallée



Routes in Delhi Map



5. Brief Reports of Research Projects

D. Targeted Programmes

Department of Science and Technology (DST) - Agence Nationale de la Recherche (ANR)

Under DST- ANR targeted programme, total six projects are ongoing. In the first call, four projects in areas of Infectious Diseases and Engineering Sciences while in second call, two projects in areas of Neuroscience and Engineering Sciences have been supported.

DENSE PARTICULATE SYSTEMS

Feb. 2014 to Dec. 2017

Background

The project concerns the rheology of particle-fluid suspensions and dry granular materials, in the regime where the particle and fluid inertia play no role. A principal objective is to bridge the descriptions between the fluid-dominated Stokesian suspension and the contact-dominated granular medium. The collaborator's aim to quantify the extent to which the fluid and contact play role in the rheology of suspensions and saturated granular materials. The Principal Collaborators will address this problem by using the unconventional experimental tools that they have developed using particles of controlled rough and stiffness, and by computations. Other objectives are to attempt to answer some open questions, such as what are the normal stress differences in dry granular materials?; how does the rheology depends on the particle roughness; and how do microstructural features vary between dense suspensions and dry granular materials? Answers to these will lead to a fundamental understanding of the rheology of particulate materials, and thereby more accurate constitutive models.

Objectives

- To study the rheology and dynamics of dense particulate systems with and without a viscous interstitial fluid, and understand the relation between the particle-scale properties and the macro scale response

Knowledge Generated / Products Developed

- Dry granular flows
- Particle-liquid suspensions
- Synthesis and characterization of soft microspheres
- Synthesis of rough microspheres
- Rheological experiments

Principal Collaborators



Prabhu Nott
Indian Institute of Science
Bangalore



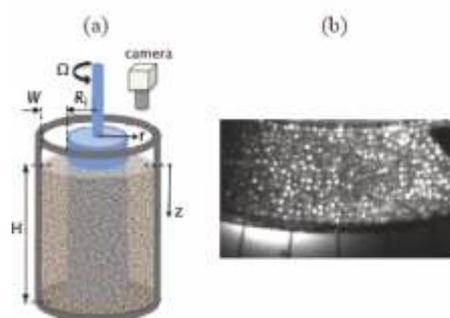
Elisabeth Guazzalli
Aix-Marseille Univ., CNRS
Marseille

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: 6

Mobility Support

- India to France: Nil
- France to India: Nil



(a) Schematic of the cylindrical Couette apparatus. The granular (glass beads) is in the annular gap between the two coaxial cylinders. (b) Streamlines of the secondary flow in the r-z plane

UNRAVELLING NEW FUNCTION FOR H-NS FAMILY OF PROTEINS IN GRAM NEGATIVE BACTERIAL PATHOGENS

Apr. 2014 to Dec. 2017

Background

This project aims at unravelling the molecular mechanisms underlying essential aspects of regulation in bacteria by proteins of the nucleoid associated H-NS family in the context of enterobacterial virulence. The family members include H-NS, StpA, Hha, YdgT, and the pathogen specific Ler protein, which will be examined for (i) silencing of genes that are encoded by bacterial pathogenicity islands, (ii) binding to specific sequences in DNA and RNA in mediating nucleoid structure and gene regulation at the transcriptional and post transcriptional levels, and (iii) modulation of the process of Rho dependent transcription termination by formation of polymeric scaffolds on DNA and/or RNA. It is expected that these studies will help illuminate the mechanisms by which the H-NS protein family act as pleiotropic regulators of adaptation of bacteria to different environmental conditions and of bacterial pathogenesis in humans and other mammalian hosts.

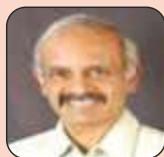
Objectives

- Investigation of virulence regulation by H-NS and Ler proteins through analysis of nucleoprotein complexes and gene transcription at AFI and LEE pathogenicity islands and control genomic loci
- Identification of RNAs from enteropathogenic *E.coli* and *E.coli* K-12 that specifically bind to StpA, H-NS, and Ler homomeric and heteromeric complexes, and characterizing their role in transcriptional and post transcriptional gene regulation
- *in vivo* and *in vitro* delineation of the roles of H-NS family proteins in modulation of Rho dependent transcription termination

Knowledge Generated / Products Developed

- Demonstrated for the first time directly that the proteins Ler and H-NS share similar specificities for binding to DNA, and that the antagonistic effect of Ler against H-NS action is likely to be related to the former's subtly different mode of binding to the DNA motifs recognized by H-NS
- Presence of Ler and H-NS proteins are necessary to observe a novel bimodality in the cell population relating to expression of the LEE operon
- RNA-Seq experiments indicate that the proteins H-NS, StpA and HU, all of which are well described as DNA-binding proteins, can also bind specific species of bacterial RNAs
- H-NS inhibits transcription *in vitro* in Initiation + Elongation and Elongation only assays, and several dominant-negative H-NS variants including L26P, I119T and Δ92 reverse this inhibition. H-NS Δ64 and Hha proteins by themselves inhibit transcription *in vitro*

Principal Collaborators



J Gowrishankar
Centre for DNA Fingerprinting & Diagnostics
Hyderabad



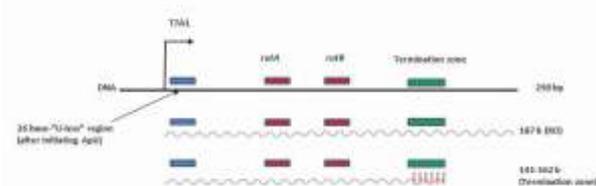
Sylvie Rimsky
Dynamique des chromosomes
Centre Interdisciplinaire de Recherche en
Biologie (CIRB), Collège de France
Paris

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 1
- France to India: 3



Features of 290-bp linear DNA template used for *in vitro* transcription assays, depicting the positions of transcription-initiation site of T7 A1 promoter, the U-less 26-base transcript region following the ApU start site, rut sites and Rho-dependent transcription termination zone. See text for details. Wavy lines depict full-length run-off (RO) transcripts (187 bases) and those terminated by Rho action in the termination zone (141 to 162 bases)

COMPLEX OXIDE NANO-CRYSTALLINE SYSTEMS FOR CHEMICAL SENSORS

Apr. 2014 to Mar. 2017

Background

The project is on complex oxide systems including spinel ferrites and their response towards sensing low reactive gases like CO₂. The work done include working with sensors of various forms including pellets made from nano crystalline powders, thick films prepared by screen printing and tape casting (using double doctor's blade) and thin films deposited by RF sputtering and PLD. This project also aims to probe in to the sensing mechanisms in order to understand the reasons for the reactivity of certain metal oxide systems to specific gases. It aims to improve the performance of chemical sensor in terms of sensitivity, selectivity and stability. The interest will also be to reduce the response time, recovery time and the operating temperature of the sensor.

Objectives

- To find suitable combination of semiconducting metal oxide composite materials comprising of iron containing nanocrystal line spinel ferrites (e.g. Mg ferrite and Ni ferrite in conjunction with oxides like copper oxide) which may work as sensors for the detection of low reactive gases like CO₂
- To minimise the response time, recovery time and operating temperature for such sensors
- To improve the sensitivity of complex oxide nanocrystalline sensors towards through systematic experiments on the chosen systems CO₂
- To improve selectivity towards certain gas species
- To do *in situ* hall effect and impedance measurement

Knowledge Generated / Products Developed

- CuO–Cu_xFe_{3–x}O₄ nano composites thin films were deposited with Alcatel A450 apparatus using a custom-made sintered ceramic target of pure CuFeO₂ with a relative density of 70%
- CuO–Cu–ferrite multilayer thin film structures were deposited by pulsed laser deposition technique on the Ti-platinised silicon substrate

Principal Collaborators



D.N. Ventakata Ramani
Indian Institute of Technology- Bombay
Mumbai



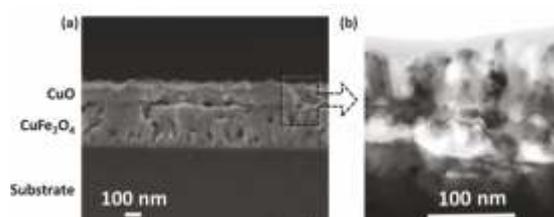
Antonie Barnabe
Université Paul Sabatier - Toulouse III
Toulouse

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 2

Mobility Support

- India to France: Nil
- France to India: 1



(a) SEM and (b) TEM micrographs in cross section view of the sample (~300 nm) annealed at 450°C in air for 12 hr.

SOLUBLE MEDIATORS OF THE HOST INNATE IMMUNE SYSTEM AGAINST *ASPERGILLUS FUMIGATUS*

Apr. 2014 to Dec. 2017

Background

Aspergillus fumigatus, though a saprophyte growing on decaying vegetation, is the most ubiquitous opportunistic human fungal pathogen. It causes a number of diseases such as lung/sinus aspergilloma and allergic bronchopulmonary aspergillosis in the predisposed immunocompetent human population. However, the most fatal one is the invasive aspergillosis (IA), a systemic infection in the immuno compromised individuals; the frequency of IA has risen more than 10-folds worldwide in the last two decades. *A. fumigatus* spores (conidia) entering the human lung alveoli are confronted with the innate immune system, both cellular barriers and soluble mediators. The role played by cellular barriers in evading *A. fumigatus* is quite well studied but that of the soluble mediators (complement system, collectins and antimicrobial peptides) is yet to be deciphered. Our project is focused on the interaction between *A. fumigatus* and the soluble mediators of the innate immune system. Accordingly, the main goals are as follows: *Host* → *fungus*: To understand the exact role played by the soluble mediators as immune effector elements against *A. fumigatus*. *Fungus* → *host*: To understand the role of *A. fumigatus* secretome in establishing pathogenicity by acting against defense mechanisms played by the soluble mediators of immune system.

Objectives

- To decipher the influence of *A. fumigatus* morphotypes and their cell wall components on the activation of the soluble mediators of the immune system
- To analyze the role of *A. fumigatus* secreted proteins on the complement system and collectins and antimicrobial peptides
- To study the antifungal effect of host defense (antimicrobial) peptides, alone or in combination with other drugs

Knowledge Generated / Products Developed

- *Fumigatus* secreted metalloprotease, Mep1, is capable of shutting down all the three major pathways of complement activation; *A. fumigatus* conidia are major infectious morphotype and Mep1 is conidia associated, secreted into medium containing collagen and albumin
- Alkali-insoluble fraction, composed mainly of β -1,3-glucan, chitin and galactomannan could activate all the three (classical, alternative and lectin) pathways
- Different cell wall polysaccharides, chitin and α -1,3-glucan are incapable of activating any of the complement pathways.
- Galactomannan (GM) and galactosaminogalactan (GAG) could activate both classical and lectin complement activation pathways.
- Collectin SP-D recognizes melanin component on the resting conidia, galactomannan found in both conidial and germinating *A. fumigatus* morphotype and galactosaminogalactan of the germinating *A. fumigatus* cell wall
- Antimicrobial peptides have no direct role in inhibiting *A. fumigatus* growth

Principal Collaborators



Arvind Sahu
National Centre for Cell Science
Pune



Taruna Madan Gupta
National Institute for Research in Reproductive Health
Mumbai



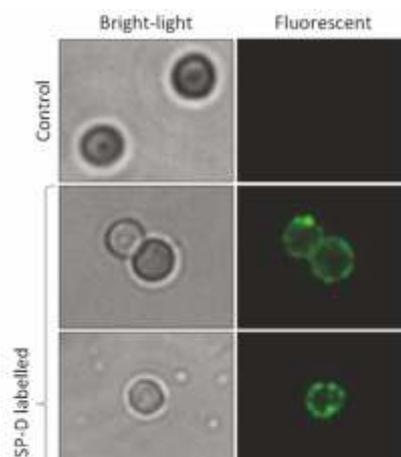
Vishnukumar Amanianda
Institut Pasteur
Paris

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 3



SP-D binds to dormant *A. fumigatus* conidia surface in punctate manner

STUDY OF THE ASSOCIATION OF MICRO RNA AND MITOCHONDRIA AND THEIR ROLE IN REGULATION OF NEURONAL CELL DEATH IN FRAGILE X TREMOR ATAXIA SYNDROME (FXTAS)

Feb. 2015 to Feb. 2018

Background

Fragile X-associated Tremor/Ataxia Syndrome (FXTAS), characterised as an X-linked inherited neurodegenerative disorder of adult males carrying CGG repeats in the Fragile X Mental Retardation 1 (FMR1) gene. FXTAS can be characterized by progressive intention tremor, ataxia and neuropsychological problems, including Parkinsonism, peripheral neuropathy, memory impairment, dementia and cognitive decline. Since, not much is known about the mechanisms of cellular pathology and the exact mechanisms of neuronal cell death, it would be interesting to decipher the root causes. Moreover, owing to the recent discovery of the micro RNA association to FXTAS and mitochondrial dysfunctions in a closely related neurodegenerative disease like Parkinson's, we set to investigate the cross linkage of mitochondrial dysfunction and spatiotemporal involvement of miRNA in FXTAS. This may open a whole new horizon to the project and may help in understanding several other neurodegenerative diseases severely affecting the society.

Objectives

- Analysis of micro RNAs association with mitochondria in FXTAS cell models, mouse models and patient brain samples
- Analysis of altered association of mitochondrial-specific micro RNAs on cellular processes specifically on mitochondrial function and neuronal cell survival
- Determine whether re-expression of a specific subset of micro RNAs could rescue neuronal cell death in models of FXTAS

Knowledge Generated / Products Developed

- Mouse model for FXTAS
- CGG repeats decreased cellular viability
- CGG repeats modulated mitochondrial functions
- Mitochondrial MAVS plays essential role in FMR induced cell death
- Effect of CGG repeats on TRIM NHL proteins

Principal Collaborators



Rajesh Singh
M.S. University of Baroda
Vadodara



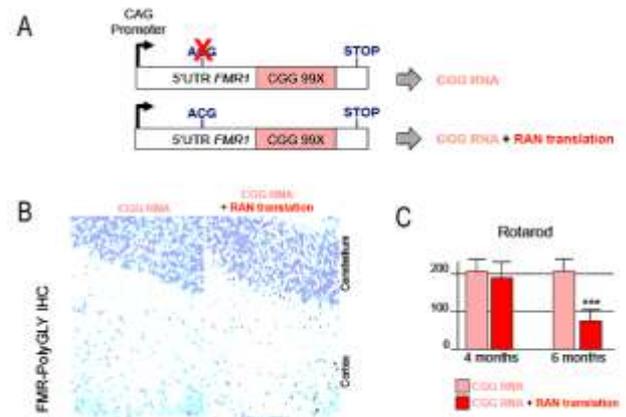
N. Charlet Berguerand
INSERM DR2
IGBMC
Illkirch

Publications

- No. of publications in SCI journals: Nil
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 3
- France to India: Nil



CGG repeats induced pathogenicity in mice model

SELF-SORTING DONOR AND ACCEPTOR ASSEMBLIES

Jan. 2015 to Dec. 2017

Background

The project aims towards understanding the structural nuances that influence the Hbonding mediated co-assembly of bis-amide functionalized dialkoxy-naphthalene (DAN) donors and naphthalene-diimide (NDI) acceptors using state-of-the art facilities including isothermal titration calorimetry (ITC), Cryo-TEM, small angle X-ray scattering (SAXS) and neutron scattering experiments (SANS) in addition to the NMR, UV/vis and fluorescence spectroscopy. In the recent past, PIs have demonstrated that self-sorting, alternate stacking or co-existence of both possibilities may arise in such D-A systems depending on the variation of the relative distances between the two amide units in the DAN and NDI units. However, so far studies have been limited to understanding the molecular scale interaction while the project aims for better understanding of their macroscopic properties which will ultimately decide the relevance of the knowledge developed (even if not the actual materials) in device applications. PIs also propose to extend the structural diversity of the building blocks by bringing in amphiphilicity to explore further structural variation and solvent combinations for tunable co-assembly.

Objectives

- To understand the role of H-bonds in the mode of co-assembly (alternate or segregated) and in the shape of the self-assemblies
- To identify the molecular parameters that govern the co-assembling mode or its reorganization (strength and number of H-bonds)
- To understand the role of the solvent, especially when reorganization occurs
- To find and optimize the conditions to obtain solid state films with the same structures and photo physical properties as in solutions; these films will be oriented and the self-assemblies studied by electron diffraction. The charge mobility will be measured in relation with the morphology of the aggregates (a) Synthesis of various structurally related amide/urea functionalized DAN and NDI building blocks and understanding role of H-bonding on co-assembly

Knowledge Generated / Products Developed

- Synthesis of series of amide functionalized NDI-acceptor molecules
- Study on their self-assembly pathway and attempts to correlate their structure with self-assembly mechanism
- Determination of structure of self-assembled NDI molecule (one among few synthesized molecules)
- H-bonding driven hydrogelation of new NDI building blocks
- Identification of new H-bonding motif for extended assembly of NDI derivatives

Principal Collaborators



Suhrit Ghosh
Indian Association for the
Cultivation of Science
Kolkata



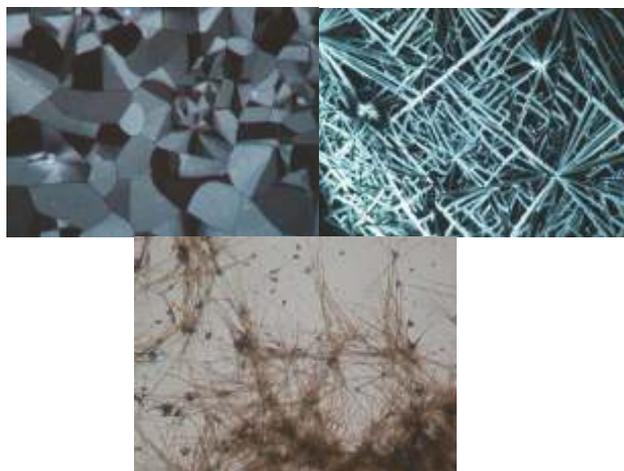
Philippe Mesini
Institut Charles Sadron
Strasbourg

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: Nil

Mobility Support

- India to France: 2
- France to India: Nil



Optical micrographs of the polymorphs of NDI-C8. From left to right: Form I = helices, Form II = spherulithes, Form III = fibres

Department of Science and Technology (DST) - Institut national de recherche en informatique et en automatique (Inria) - Centre national de la recherche scientifique (CNRS)

The programme was initiated during the FY 2013-14, where CNRS & Inria support the French component of the programme, DST supports the Indian component. On behalf of DST, CEFIPRA manages the implementation of programme on the Indian side and coordinates between French & Indian organizations. The focus of DST-Inria-CNRS Targeted programme is on the areas of Big Data, Cyber-Physical Systems, High Performance Computing, Embedded Systems, Reliable and Scalable Computation, Computer Science for Biology and Life Sciences, Cyber Security and Machine Learning. The progress of eight ongoing projects supported under the programme is as follows:

PERSONALIZED MOBILITY SERVICES FOR URBAN TRAVELERS

Aug. 2014 to Aug. 2016

Background

With over 70% of the world's entire population expected to be living in cities by 2050, supporting citizens' mobility within the urban environment is a priority for municipalities worldwide. Although, public multimodal transit systems are necessary to better manage mobility, but these are not sufficient. Citizens must be offered personalized travel information to make their journeys more efficient and enjoyable. Notably, such information should not only be objective (e.g., bus timetable, live bus tracking), but crucially personalized since every passenger preferences and interests differ (e.g., crowdedness of trains, heat of tube platforms, sociability of the coaches). To enable this, a multitude of research problems need to be solved. On the one hand, efficient techniques for mobile participatory sensing are required to create robust mobile distributed systems that can provide on demand sensing information at a large scale. This needs to then be complemented by domain specific machine learning algorithms, which must be able to execute on resource constrained mobile devices with heterogeneous configurations.

Objectives

- Development of a scalable data collection middleware and personalized mobility services
- Learning and mining techniques for sustainability
- Development of a demonstrator for real-life assessment

Knowledge Generated / Products Developed

- A mobile application for gathering passenger experience in metro trains has been developed, deployed and is available on Google Play Store (Beta version)
- Simulated the behavior of different recommendation engines on the convenience dataset collected using the Android application. Work is currently being carried out to validate these recommendation approaches using Conjoint Based Analysis
- Working on to develop the prototype of the communication middleware required to identify the best interaction paradigm to communicate with commuters in public transit dealing with intermittent network connectivity

Principal Collaborators



Puspendra Singh
Indraprastha Institute of Information
Technology (IIT), Delhi

Publications

- No. of publications in SCI journals: 2
- No. of papers presented in conferences: 6



Rachit Agarwal
Institut national de recherche en
informatique et automatique (Inria), Paris

Mobility Support

- India to France: Nil
- France to India: Nil

Screenshots from MetroCognition



Screenshots from metro cognition

BASAL GANGLIA AT LARGE

Aug. 2014 to Aug. 2017

Background

Structures such as the Pre-Frontal Cortex (PFC), the Basal Ganglia (BG) and the Hippocampus are studied in cognitive neuroscience to understand reasoning and planning particularly through the consequences of lesions in the system and neurodegeneration. Computer science is playing an increasingly important role in the domain of Computational Neuroscience, through the design of models that are new experimental tools to neuroscientists that can also be used in the domain of Artificial Intelligence and Machine Learning for the design of intelligent and adaptable artificial systems. Many computational models of the neuronal structures have been proposed and validated using data from experiments in neuroscience and medicine. Nevertheless, most of these modeling approaches have important limitations in terms of size of the networks and their biological plausibility. This is being addressed in this project by simulating large models possibly eliciting large scale effects (eg. noise, spontaneous activity, emerging properties) and on realistic tasks involving multiple and large information flows.

Objectives

The primary objective is to select a few classical models of the Basal Ganglia (BG), the prefrontal cortex (PFC) and the Hippocampus and of their interconnections and to expand them to larger scale, with realistic anatomical and functional connectivity. The aim is to implement and test these models on tasks where the input (sensory) and output (motor) information flows are larger and hence more realistic.

Knowledge Generated / Products Developed

- Developed a large scale model of basal ganglia along with a cortical pathway, that can control an arm model and produce reaching movements
- Developed also a detailed model of the striatum that incorporates the striosomes and matrixome

Principal Collaborators



Bapi Raju
International Institute of
Information Technology (IIIT),
Hyderabad



V. Srinivasa Chakravarthy
Indian Institute of
Technology Madras
Chennai



Frédéric Alexandre
MNEMOSYNE team - Inria Bordeaux
Institut des Maladies Neurodegeneratives
CNRS UMR 5293
Bordeaux

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 1
- France to India: 1

ALGORITHMIC VERIFICATION OF REAL TIME SYSTEMS(AVERTS)

Sept. 2014 to Aug. 2017

Background

Digital systems control most of the devices that surround us. Timing constraints are often crucial for cyber-physical systems that are designed to interact with the physical world. Correctness of cyber-physical systems that work under time-constraints is an ongoing challenge since traditional methods based on testing are no longer applicable in a safety-critical setting. This project aims at enlarging the applicability of formal verification for certifying correctness of timed systems. The model of timed automata has been introduced more than 25 years ago and has been an object of intensive study. It has also been successfully used in verification of cyber physical systems. A verification system Uppaal based on the timed automata model, has been developed for the last 20 years. In 2013, it has received the Computer Aided Verification award for “becoming an industrial-strength tool for computer-aided verification of computing systems that has been applied to many case studies by several research groups in academia and industry”. Since the last four years, collaborators are working on improving state of the art algorithms for the verification of timed cyber physical systems. The research results open a way to new approaches to algorithmic verification of timed systems. The goal of this project is to explore these new possibilities, and to make them accessible to industrial designers. Collaborators aim at constructing a tool that will be able to verify bigger systems and will facilitate the use of formal verification methods by designers.

Objectives

The project aims at developing formal methods for the automatic design and analysis of real-time systems. Digital systems control most of the devices that surround us. Timing constraints are often crucial for cyber-physical systems that are designed to interact with the physical world. Correctness of cyber-physical systems that work under time constraints is an ongoing challenge since traditional methods based on testing are no longer applicable in a safety- critical setting. The project aims at enlarging the applicability of formal verification for certifying correctness of timed systems. In the last years, PCs have been working on improving state of the art algorithms for the verification and synthesis of timed cyber- physical systems. The results have opened a way to new approaches to algorithmic verification of timed systems. The goal of this project is to explore these new possibilities, and to make them accessible to industrial designers.

Knowledge Generated / Products Developed

- Better abstractions for timed automata
- Distributed timed systems
- Reachability Problems in Timed Automata and Games

Principal Collaborators



S. Krishna
Indian Institute of Technology-Bombay
Mumbai



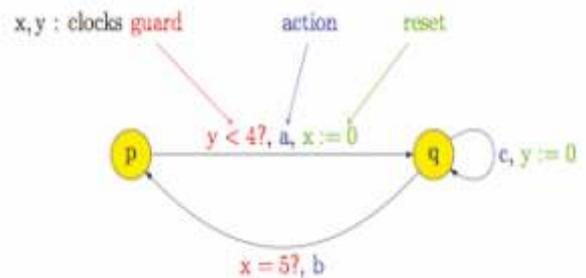
Frédéric Herbreteau
Domaine Universitaire
Talence

Publications

- No. of publications in SCI journals: Nil
- No. of papers presented in conferences: 5

Mobility Support

- India to France: 2
- France to India: 1



Timed Automata: Modelling Timed Systems

OPTIMAL INFERENCE IN COMPLEX AND TURBULENT DATA

Sept. 2014 to Aug. 2017

Background

The project's main emphasis on data fusion in earth observation and monitoring. Non-linear physics puts strong evidence of the fundamental role played by multiscale hierarchies in complex and turbulent data: in these data, the information content is statistically localized in geometrical arrangements in the signal's domain, while such geometrical organization is not attainable by classical methods in linear signal processing. This is one of the major drawbacks in the classical analysis of complex and turbulent signals. The goal of this associated team is to show that inference of physical variables along the scales of complex and turbulent signals can be performed through optimal multiresolution analysis performed on non-linear features and data extracted from the signals, resulting in novel and powerful approaches for data fusion between different acquisitions (in temporal/spatial/spectral resolutions).

Objectives

- New methods in data fusion of signals acquired at different spatial resolutions and having different spectral characteristics: for instance data fusion of optical, radar and hyper spectral data for enhanced classification
- Non-linear methods to fuse the satellite images for bringing the different sensor data in same scale characterization of universality classes in observed data. Comparison with compressive sensing approaches
- Enhancement of data fusion techniques in Earth observation data between datasets acquired at different spatial resolutions. Application to radar and optical data for the development of Earth's monitoring system
- Derivation of new non-linear methods for reconstructing a perturbed phase in Adaptive Optics from low resolution sub-gradients
- Effective Application of huge satellite data with different variety by using/developing Fusion techniques for development of specification of certain Earth monitoring system like agricultural, land cover and ocean dynamics
- Research on development of missing data using Non-linear signal processing techniques, so spatial ambiguity of huge satellite data set may be resolved
- Research and development for resolving the difficulties of huge satellite data veracity from different sensors (because different satellite has different quality, different time line and different accuracy data) for making the usable data in same scale
- Development of monitoring methods, based on change detection, pattern recognition techniques and nonlinear signal processing, for analyzing time series of satellite data in order to detect possible precursors of imminent changes in agricultural field

Knowledge Generated / Products Developed

- Specification for huge satellite data has been identified which can monitor the earth surface especially land cover with minimum human interaction
- An adaptive land cover change monitoring algorithm has been developed which will be quite useful for development of earth monitoring system

Principal Collaborators



Dharmendra Singh
Indian Institute of Technology(IIT)-Roorkee
Roorkee



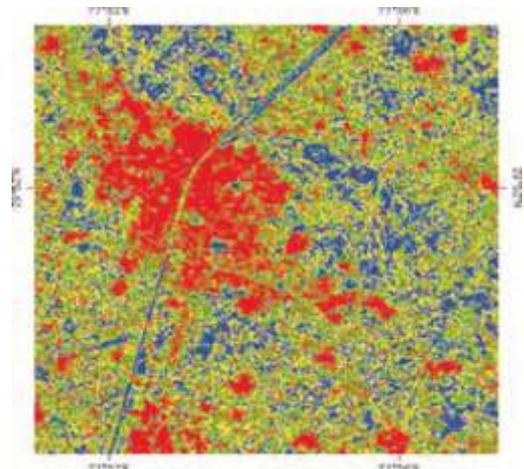
Hussein Yahia
Institut national de recherche en
informatique et automatique (Inria)
Talence

Publications

- No. of publications in SCI journals :2
- No. of papers presented in conferences: 3

Mobility Support

- India to France: 1
- France to India: Nil



Classified PALSAR-1(Phased Array L-Band Synthetic Aperture Radar) image with fusion of color histograms using PCA of the Roorkee region of India (Red-Urban, Blue-Water, Green-Vegetation, Yellow-Bare Soil)

EVOLVING COMMUNITIES AND INFORMATION SPREADING

Aug. 2014 to Dec. 2017

Background

The project explores the properties of real world networks and investigates the behaviour of inherent community structures and information diffusion. Community formation needs to be studied considering the fact that most of the real networks exhibit multilayer structure. Moreover, it is now realized that the real networks are temporal in nature, hence communities evolve with time and studying a snapshot of such time instance produce incomplete picture. Several dynamics play important role, for example, understanding emergence of new links (aka. friendship/relationship) in the network, which can form the basis of any recommended system, rate at which information disseminates over the network important is to understand epidemic, rumor spread etc. In the current project, collaborators approach the problem from various angles like – building models/algorithms to detect dynamic community, model information spread in social network (Twitter), collecting large time-stamped network data, defining new metrics as well as building benchmark data to evaluate the goodness of dynamic communities.

Objectives

- Information diffusion in temporal networks: (a) predict temporal links taking the community signals in consideration (b) understand the role of communities in enhancing/slowing the speed of information spread – we would like to formulate the role of communities in robustness of temporal graphs (c) go beyond spread and try to understand the role of dynamic communities in making various topics / events viral (trending) over network
- Dynamic communities: The main goal is to develop new methodologies / frameworks for analyzing dynamic communities because the traditional algorithms are unable to handle temporal aspects of the communities
- Big Dataset: Aims at collecting and generating data – both synthetic and real. Plans to work with two types of data set – (a) citation-collaboration network of Computer Science and Physics (b) twitter networks along with the tweets posted by users

Knowledge Generated / Products Developed

Created two real world multilayer networks from Yelp and Twitter datasets

- Proposed two simple algorithms – i) collapsing all layers into a single layer network and then applying standard community detection techniques ii) applying community detection techniques in each network layer separately and then considering the detected communities as nodes, applying the community detection once again
- Applied both the algorithms on the real networks and compared their results with respect to number of detected communities, their sizes, the balance of different types of nodes in those communities etc
- Also applied collaborative filtering and compared those recommendations with communities detected by these two simple algorithms
- Built a benchmark synthetic multilayer network generator with ground truth communities

Principal Collaborators



Bivas Mitra
Indian Institute of Technology-Kharagpur
Kharagpur



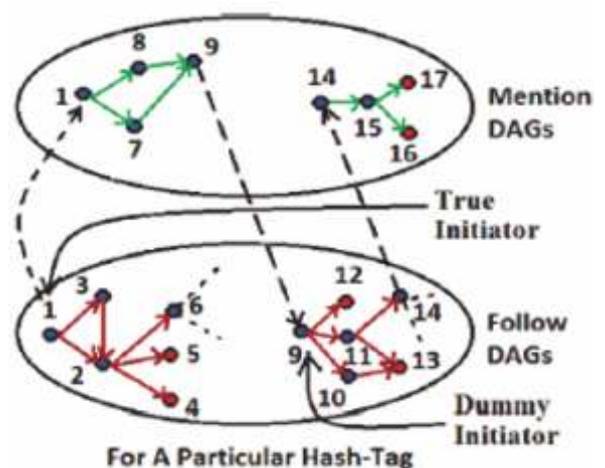
Jean Loup Guillaume
University of La Rochelle
Technoforum, La Rochelle

Publications

- No. of publications in SCI journals : 4
- No. of papers presented in conferences: 3

Mobility Support

- India to France: 2
- France to India: 3



POST-STROKE TELE-NEUROREHABILITATION USING AN OPERANT CONDITIONING PARADIGM UNDER VOLITIONALLY DRIVEN TRANSCUTANEOUS NEUROMUSCULAR ELECTRICAL STIMULATION

Sept. 2014 to Aug. 2017

Background

Stroke is a global health problem and fourth leading cause of disability worldwide. In France, stroke is the leading cause of acquired disability in adults. While the incidence of stroke is decreasing in developed world, the incidence is increasing in India. Unfortunately, India is in dire need for neuro-rehabilitation facilities and this may strain India's health care system in the coming years. One of the most common complications after stroke is lack of balance and falls that adversely affects most day-to-day activities. This research project aims to develop a use-inspired neuro-physiology-based operant conditioning paradigm that is based on volitionally-driven Neuro-muscular Electrical Stimulation to generate functional movement for restorative neurorehabilitation. Collaborators plan to develop a clinically valid, low-cost home-based tool for post-stroke balance and movement therapy, which can be used both in rural and urban community settings, will be a paradigm shift for neuro-rehabilitation in India.

Objectives

- To develop a cyber-physical system for tele neuro rehabilitation by integrating bio signal sensors, eye tracker, and motion capture to deliver volitionally driven multi-channel neuromuscular electrical stimulation (NMES)
- To develop gaze interaction with biofeedback as the human-machine interface for the cyber physical system to enforce active supra spinal participation for operant conditioning
- To validate the cyber physical system for individualized post-stroke tele neuro rehabilitation

Knowledge Generated / Products Developed

- Developed human machine interface integrated with Wii Balance Board and completed preliminary pilot testing
- Pilot testing was done with balance related biofeedback given to participants along with gaze monitoring and studying their implication on one's balance

Principal Collaborators



Uttma Lahiri
*Indian Institute of Technology(IIT)
Gandhinagar*



Mitsuhiro Hayashibe
*Institut national de recherche en
informatique et automatique (Inria)
Paris*

Publications

- No. of publications in SCI journals: 7
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 3
- France to India: 3

AUTOMATED VERIFICATION OF CONCURRENT SOFTWARE (AVeCS_o)

Oct. 2015 to Sep. 2018

Background

There is a real need to investigate both foundational as well as practical issues related to the automated verification of modern concurrent and distributed software. The need concerns both (1) methods for efficient bug detection, which are very useful to programmers at early stages of software development, and (2) methods that allow us to establish the correctness of a system, which is useful to certify the software before its release. The goal of this project is to design such new, advanced algorithmic methods, guided by the recent developments in multi-core architectures and cloud-computing.

Objectives

To design algorithmic methods for the automated verification of concurrent software systems

- Models and verification algorithms for concurrent programmes
- Verification of concurrently shared data structures
- Verification of distributed, geo-replicated data structures

Knowledge Generated / Products Developed

- Specification and verification of quantitative properties of concurrent programmes
- Verification of asynchronous event-driven programmes with locks
- Consistent implementation of distributed data structures
- Parametric verification of distributed protocols
- Language theoretic properties of counter systems

Principal Collaborators



Madhav Mukund
*Chennai Mathematical Institute
Chennai*



Ahmed Boujjani
*University Paris Diderot (Paris 7)
Paris*

Publications

- No. of publications in SCI journals: 1
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 2
- France to India: 3

BiDEE- A BIG DATA PERSPECTIVE FOR ENERGY MANAGEMENT IN GRIDS AND DWELLINGS

Oct. 2015 to Sept. 2018

Background

Smart grids and smart buildings allow information exchange and processing between electricity consumers and/or producers, and therefore opens the gate to consumer behavior analysis and potentially more effective energy management. Moreover, with the huge amount of energy related data being collected regularly, scalability of the developed algorithms to big data becomes an important consideration. There are two levels at which the project is approached: 1) The building level and 2) the grid level. The aim of the project is to apply game theoretic, optimization and learning techniques to the problem of energy management in smart grids and smart buildings. The enormous amount of data during the analysis process is to be handled by Big Data analysis.

Objectives

- At a building level, the main objective is estimation of human activity and adapting it to be relevant to grid requirements
- At a grid level, the main objective is the study of strategic interactions, both unilateral and collaborative, between micro-grids

Knowledge Generated / Products Developed

- A study explored the use sensors in smart buildings to present to the user the impact of past actions, with respect to optimal actions in terms of minimal thermal and air quality dissatisfaction, to achieve better energy management strategies. Multi objective Optimization with Differential Evolution was used provide a set of actions which optimizes the comfort of the occupant in a building. The work is under review for publishing
- A game theoretic model for Demand Side Management was developed where Stackelberg Games were utilized to reduce Peak to Average demand ratio. Experiments carried out on simulated data showed the effectiveness of the models in incentivizing users into offloading consumption onto non-peak hours
- A framework for optimal energy management in a micro grid has been developed and studied. A global energy network with heterogeneous types of producers and consumers from which different types of behaviors and interactions has been studied in this work. The results from this work were later published
- Hybrid neural network systems have been explored for the process of modeling short term load prediction as well as renewable energy forecasting. A combination of Convolutional Networks and Long-Short Term Memory based Recurrent Neural Networks have provided encouraging results in time series based power and load forecasting
- A Simulated Annealing based discrete time model was developed to study the optimal generation schedule for the Distributed Energy Resources by minimizing the operational cost. The experimental results showed economic feasibility of the method in an energy market and was later published
- Optimal Power Flow under Competitive Bidders was studied where an electricity market model is formulated and analyzed under various real-life scenarios using Game Theory and Optimization Tools

Principal Collaborators



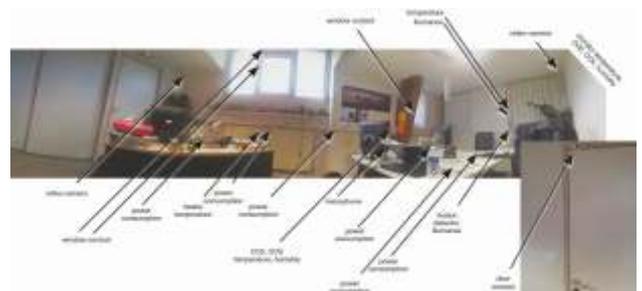
Ujjwal Maulik
Jadavpur University
Kolkata



Sangmitra Bandhopadya
Indian Statistical Institute
Kolkata



Stephane Ploix
G-SCOP lab UMR
CNRS 5272, Grenoble INP
Grenoble



Experimental Framework

Publications

- No. of publications in SCI journals : Nil
- No. of papers presented in conferences: 1

Mobility Support

- India to France: 1
- France to India: 2

Department of Science & Technology (DST) - Institut national de la recherche agronomique (INRA)

CEFIPRA initiated its first targeted programme in 2012 between DST and INRA in the area of integrated water management in agriculture in the context of climate change. Following one project is ongoing under this programme.

Adaptation of Irrigated Agriculture to Climate Change

Background

The expected impact of climate change on agriculture and water resources is the subject of an ever growing literature. The problem of excessive groundwater extraction has resulted in declining groundwater levels, water quality deterioration, rise in extraction costs, depletion of well yield and failure of wells in peninsular India. Addressing this question requires considering the interactions between all the components of the system, including hydrology, economics and agronomy. Few attempts of integrative assessment using coupled economic and agro-hydrogeological models for optimizing the economic benefits of agriculture and sustainable groundwater levels are found in the literature. The impact of climate change on local agricultural producers has been addressed in some cases. However, there is lack of integration between the water management aspects, the agronomic issues and the perspective of climate change.

Objectives

In the context of climate change and of agriculture increasingly relying on groundwater irrigation, it is crucial to develop reliable methods for sustainability assessment of current and alternative agricultural systems. The project aims to develop an integrated model (in agronomy, hydrogeology and economics) and scenarios of evolution of agricultural systems and water management policies, which is being tested both at the farm scale and the watershed scale in the case of an experimental watershed in Peninsular India. It is proposed to combine both economic impacts on the crop production and hydrogeological regime and hydro-economic feedbacks on the future land use and productivity. A methodology combining remote sensing, field surveys and inverse modeling for retrieving spatially distributed relevant biophysical parameters and factors determining cropping systems will be used. A farmer decision model will be developed to investigate the farming system adaptability to changing climate or economic context.

Knowledge Generated / Products Developed

- The proof of concept for retrieving distributed soil properties by model inversion using STICS and soil moisture and crop variables from satellite data (radar) was finalized and published
- A spatio-temporal downscaling method of soil moisture from passive microwave (SMOS) using active microwave (RADARSAT-2) was developed and tested
- An innovative method to map the land use and land cover changes from a multi-temporal satellite dataset of low resolution images using Brovey Transformation was developed. In particular, it helped in constructing the evolution of the irrigated area in the watershed for the period 1973-2012

Principal Collaborators



Sekhar Muddu
Indian Institute of Science
Bangalore



Laurent Ruiz
Institut National de la
Recherche Agronomique
Rennes-Quimper

Publications

- No. of publications in SCI journals : 5
- No. of papers presented in conferences: 16

Mobility Support

- India to France: 4
- France to India: 6

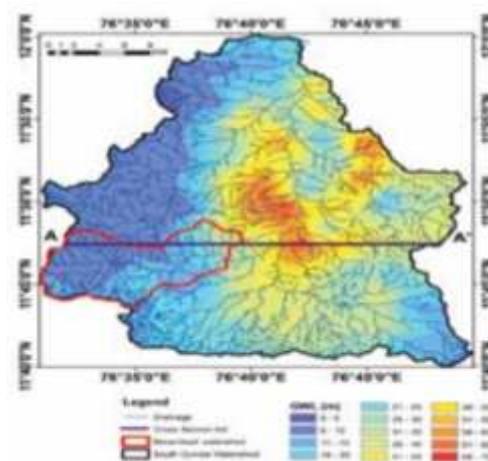


Illustration of the data acquisition in the South Gundal watershed : stream drainage and depth to groundwater levels

Indo-French Water Network (IFWN)

Considering the strong urge of the Indian and French Governments to reinforce scientific collaboration to address prevalent and emerging challenges in the area of Water, the French Embassy in India and the Department of Science & Technology (DST), Govt. of India have joined hands for Indo-French scientific networking programme in this area. This networking programme has been implemented by CEFIPRA under the name of Indo-French Water Network (IFWN) programme. The objectives of this programme are to form dedicated networks of Indian and French research groups & industries to address identified water related issues; to strengthen and expand the quality and potential of water research in both countries by building greater interaction between France and India and to build stronger relationships between industry and academic communities in France and India coupled with better knowledge exchange, to form the basis for future collaborations, research projects, and joint endeavor related to water technology, research & innovations. The call for proposals was launched in May, 2015 in the following two areas:

1. Waste water treatment (Industrial/Domestic)
2. Natural water treatment systems

Under this call, a total of 10 proposals were received and the following two projects were recommended for support.

SWACHH NEER - UNE VIE MEILLEURE : COMBATING WATER ISSUES THROUGH INDO-FRENCH NETWORKING

Background

The present project is aimed to make a strong network involving expertise from eminent institutes of both the countries for undertaking challenging projects. To develop management training plan and give thrust to technologies giving equal weightage to augmentation of supplied water as well as development of wastewater treatment facilities with recourse to recycling, recovery, recharging, and storage so as to increase water usage efficiency and to make it available for different industrial and non-industrial end uses such as pisciculture, irrigation, forestry, horticulture, cleaning, washing etc.

Objectives

A. Data collection and review-

- Existing water availability/potential
- Population projection/ growth
- Wastewater generation and projection
- Inventory of existing wastewater management practices
- Geographical and metrological data
- Land use land cover data
- Regulatory standards

B. Treatment technologies- Develop an evaluation matrix to screen the various alternative technologies for wastewater treatment and disposal, including residuals disposal.

Selection of treatment technologies based on criteria-

- Quantification and characteristics
- Nano-cellulose from waste and analysis to use it as filter
- CNT/Fullerene based treatment technology
- Performance evaluation of various already developed, membrane and cost effective adsorbents
- An awareness drive shall be conducted in these regions to identify the gaps. Some specific sites in France & India will be considered. One of such area is in Uttarakhand, in the vicinity of IIT-R and UPES-Dehradun, identified in report of 'WAR for Water' by DST-Govt. of India

C. Demonstration and future action plan -

- Thematic learning programs in affected areas
- Preparation of preliminary cost estimates for construction and operation of the screened alternative technologies
- Compilation of data, Preparation and submission of publications
- Workshop organization and action plan for future research and collaboration

Principal Collaborators

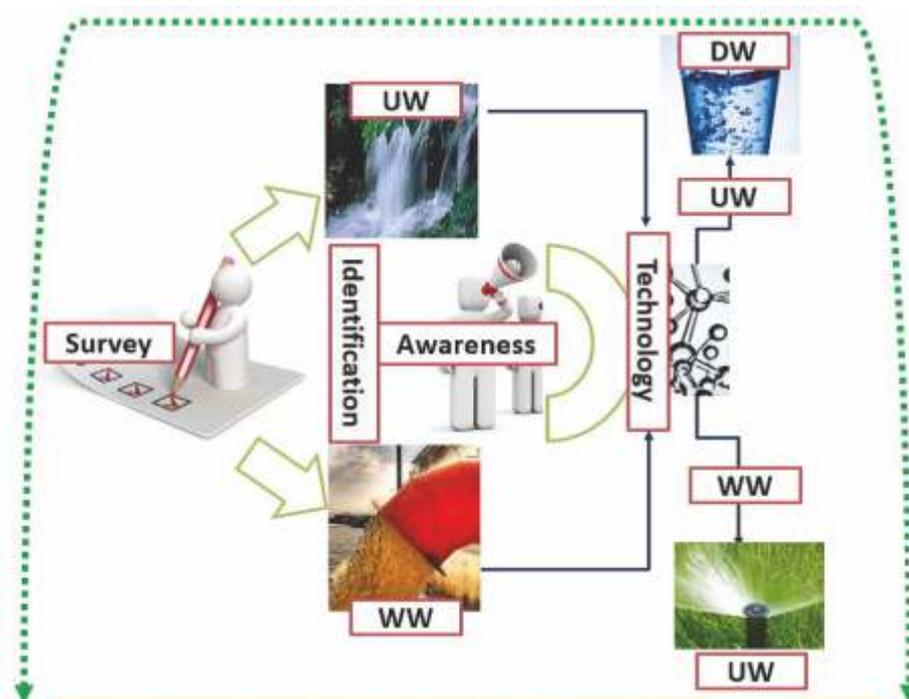


Jitendra K Pandey
University of Petroleum and
Energy Studies



Benoit Teychene
Université de Poitiers
Poitiers Cedex

S. No.	Name	Affiliation	Country
1	Dr. Parsenjit Mondal	Indian Institute of Technology (IIT), Roorkee	INDIA
2	Dr. Patrick Loulergue	Université de Rennes 1, Rennes	FRANCE
3	Dr. Sukdeb Pal	National Environmental Engineering Research Institute (NEERI), Nagpur	INDIA
4	Prof. Szymczyk Anthony	Université de Rennes 1, Rennes	FRANCE
5	Mr. Surinder Singla	Venza Water Management Solutions, New Delhi	(Industrial Partner) INDIA
6	Dr. Julie Mendret	Université Montpellier, Montpellier	FRANCE
7	Mr. Jean Milidakis	WASTE & WATER SARL , Villers-les-Nancy	(Industrial Partner) FRANCE



Indo-French networking for Swachh Neer- Une Vie Meilleure

GREYWATNET: NETWORK ON DECENTRALIZED GREY / WASTE WATER TREATMENT & RECYCLE

Background

The aim of this project is to put together a network of expertise that can address the issue of grey-water treatment and recycling as also evolve a few demonstrable technology options that are sustainable and can be run on 'hands-free' mode coupled with long mean times between maintenance and failures (MTBF).

Objectives

- Evolve a network of experts who can address the emerging challenge of decentralized greywater treatment technologies
- Assess, standardize and demonstrate two proof-of-concept streams for anaerobic-aerobic mode of greywater treatment options possessing low sludge and low maintenance characteristics
- Assess the impact of various antimicrobials grey water from domestic discharges on the treatment processes
- Subject post treated water to solar catalysis and Fenton-H₂O₂ reagent based treatment to maximize bacterial removal and assess their utility for purified greywater

Principal Collaborators

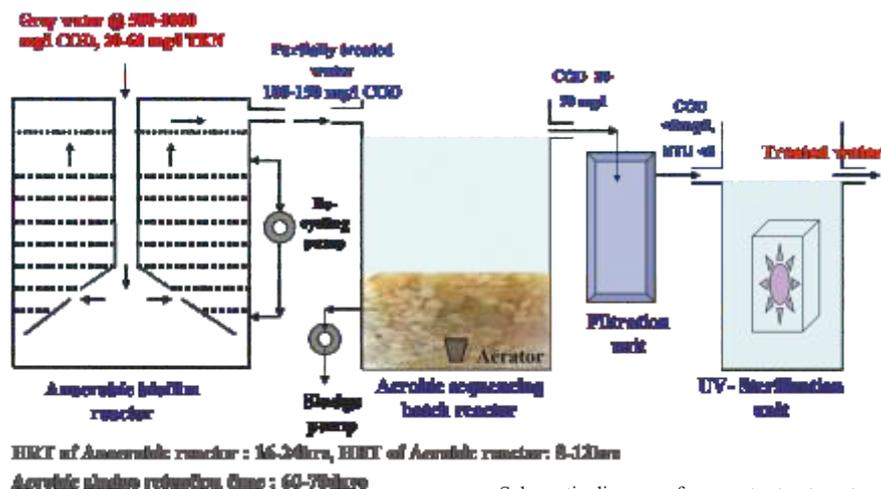


H N Chanakya
Indian Institute of Science
Bangalore



Michel Torrijos
INRA,
Narbonne

S. No.	Name	Affiliation	Country
1	Prof. M. M. Ghangrekar	Indian Institute of Technology, Kharagpur	INDIA
2	Dr. Srikanth Mutnuri	Birla Institute of Technology and Science, Goa Campus	INDIA
3	Dr. Arun Kumar Thalla	National Institute of Technology Karnataka (NITK), Mangalore	INDIA
4	Dr. Florent Chazarenc	Ecoles des Mines de Nantes (EMN), Nantes	FRANCE
5	Dr. Sarkar	Tata R&D, Jamshe dpur	(Industrial Partner) INDIA
6	Dr. Joëlle Paing	Company Jean Voisin , Beaumont-la-Ronce	(Industrial Partner) FRANCE



Schematic diagram of greywater treatment unit



5. Brief Reports of Research Projects

E. Innovation Programme Through Public Private Partnerships

BIRAC-CEFIPRA French Embassy Programme

Biotechnology Industry Research Assistance Council (BIRAC), CEFIPRA and French Embassy in India had launched an Indo-French challenge oriented programme in the area of Red Biotechnology up to pre-commercialization stage in 2 + 2 model. The areas for collaboration under the first call were Molecular diagnostics for prediction of Cardiac diseases, Alzheimer's disease and/or Dementia, Cerebral palsy and generation of new assistive technologies for the mobility of physically challenged. Second call was launched in October, 2015 with closing date as 15th July, 2016 in the areas of Molecular diagnostics for prediction of Alzheimer's and other Dementia, new assistive technologies for the mobility of physically challenged (including prosthesis and robotics applications), Biomaterials and cell engineering for health applications.

The following two projects are ongoing both in the area of cardiovascular diseases.

OXIDIZED HDL-APOLIPOPROTEIN A I AS A RISK PREDICTOR OF CARDIOVASCULAR DISORDERS AND DEVELOPMENT OF NOVEL DIAGNOSTICS

Apr. 2015 to Mar. 2017

Background

Atherosclerosis is one of the major causes of cardiovascular disease and is a chronic inflammatory condition. It is generally believed that the High Density Lipoprotein (HDL) helps in reducing the risk of cardiovascular diseases since it moves cholesterol from arteries and peripheral tissues to the liver via reverse cholesterol transport. In addition, HDL also contributes to general well-being of the cardiovascular system through its anti-inflammatory, antioxidant and anti-thrombotic properties. These protective effects of HDL are mainly believed to be mediated by Apolipoprotein A-I (ApoA1), which is the major protein component of HDL. Attempts to increase the HDL levels or HDL-Cholesterol levels pharmacologically have not been successful.

Furthermore, recent studies have suggested that the Myeloperoxidase-mediated modification of ApoA1 impairs its function as a cholesterol acceptor, in turn hampering HDL's cardio protective nature. A number of modifications, such as chlorination/nitration of Tyrosine, oxidation of Methionine, hydroxylation of Tryptophan and carbamylation of Lysine, have detrimental consequences including loss of cholesterol acceptor activity, which could significantly contribute to plaque formation. These modifications not only render HDL dysfunctional, but some of the modifications such as conversion of Tyr192 to Chl-Tyr192 or Nit-Tyr192 render ApoA1 proinflammatory and proatherogenic and this may exacerbate the CVD risks in humans.

Hence, early detection of Tyrosine modifications is the key to rapid diagnosis of cardiovascular disorders. In this project, PCs will focus on developing novel methods to identify specific modification of residues in ApoA1 using immunological methods, and test their efficacy on patients.

Objectives

- Development of murine monoclonal antibodies against nitrated, chlorinated peptides of HDL ApoA1, and its subsequent purification
- Characterization of the purified anti-Chlorinated ApoA1 and anti-Nitrated ApoA1 mAbs in terms of specificity and sensitivity
- Screening cardiovascular stroke patient samples for the effectiveness of anti-ChlApoA1 and anti-NitApoA1 mAbs
- Development cDNA expression clones for highly specific mAbs and standardization of recombinant mAb expression, pilot scale production and purification of mAbs
- Imaging studies of antibody specificity to plaques
- Large scale screening both native and recombinant anti-ChlApoA1 mAbs and anti-NitApoA1 mAbs known CVD patients
- Best mAbs will be further developed for commercialization

Knowledge Generated / Products Developed

- Developed simple purification protocol for isolation of ApoAI from plasma in 2 steps
- Developed methods to carry out proteomic analysis of ApoAI modifications from healthy volunteers and CVD patient samples
- Expressed recombinant ApoAI in bacteria, purified them for both antibody development and for antibody screening purposes
- Developed highly specific polyclonal antibody against native unmodified ApoAI full length protein
- Developed highly specific monoclonal antibodies against Chloro- 192-Tyr ApoAI, containing synthetic peptide and recombinant ApoAI full length protein

Indian Collaborators



Krishnan Venkataraman
VIT University
Vellore



Supriya Kashikar
GeNext Genomics
(GNG) Private Ltd., Nagpur



Xavier Santarelli
Université de Bordeaux
Bordeaux



Daniela Balvay
SPAN Diagnostics
S.A.R.L., Paris

Publications

- No. of publications in SCI journals : 1
- No. of papers presented in conferences: 3

Mobility Support

- India to France: Nil
- France to India: 1

French Collaborators

AMIR-PEPKIT IVD: R&D OF A PEPTIDE-BASED - DIAGNOSTIC KIT FOR AN EARLY DETECTION OF A FATAL IMMUNE RESPONSE IN ACUTE MYOCARDIAL INFARCTION PATIENTS

Apr. 2016 to Mar. 2018

Background

Cardiovascular diseases represent a leading cause of morbidity and mortality all over the world. The disease is a complex interaction of various physiological, structural, and biochemical mechanisms, which could be symptomatic at a stage where heart has exhausted all ability to compensate for the injury. Myocardial Infarction is the occlusion of a coronary artery, preventing the supply and oxygen to cardiac cells. This cardiovascular problem leads to heart failure.

The early strategies towards understanding the very early changes that the myocardium undergoes following an ischemic event may be important as that will ultimately enable diagnosing a cardiac ischemic event before it has caused significant damage to the heart. The idea of this proposal is to investigate the expression of proteins and/or aberrantly modified proteins that could have antigenic properties in AMI and try to correlate the possible antibody response to them with disease activity. In fact, recognition of specific antibodies present in sera of patients affected by diseases involving an immune response is a relevant goal because these antibodies may have not only a diagnostic but mainly a prognostic value.

Therefore, a relevant technical goal is to isolate autoantigens by affinity chromatography, identify their differential expression in MI in comparison to healthy controls by DIGE and to develop simple immunoassays using specific peptides to detect them. The advantage of using peptides compared to proteins as antigens to detect antibodies is that we can have higher specificity of recognition.

Objectives

- Identification of Antigenic Proteomic Markers
- Validation and Selection of initial markers
- Selection of Peptide Antigens/Receptors for identified antigenic proteins
- Synthesis and Purification of the Peptides
- Optimization of Peptide-Based ELISA Diagnostics for Acute Myocardial Infarction

Indian Collaborators



Savita Yadav

*All India Institute of Medical Sciences
New Delhi*



Arjun Surya

*Curadev Pharma
Private Limited
Noida*

French Collaborators



Anna Maria Papini

Université de Cergy- Pontoise



Elian Lati

*SAS GENEX –
Longjumeau*

BIRAC-CEFIPRA-Banque publique d'investissement France (Bpifrance) Programme

CEFIPRA has expanded its activity by bringing Bpifrance (a public investment bank) as a new stakeholder and launched the Indo-French health technology programme in association with Bpifrance and BIRAC in the area of red biotechnology up to pre-commercialization stage. The name of this programme is BIRAC-CEFIPRA-Bpifrance programme. First call for proposal was launched in the areas of new targets or biomarkers that lead to the development of sensitive, specific and affordable diagnostic tests, new therapeutic options in terms of therapeutic proteins or drugs and affordable process development for existing therapeutics.

For the second call for proposal launched in November, 2015 in the areas of digital healthcare (e-health, tele-care, health IT, m-health, etc.) and individualized medicine (therapeutic solutions for individual patients, pharmacogenetics, etc.), two proposals were received and will be evaluated.

Saint Gobain Research India (SGRI) Programme

In a first ever initiative of CEFIPRA in PPP (Public Private Partnership) mode, CEFIPRA entered into a MoU with SGRI on 23rd October, 2013 to launch a programme of “sustainable habitat for hot and/ or humid climates”. The areas of interest were: Improvement of Energy Performance, Indoor Air Quality, Day Lighting in Hot-Humid Climates & Cool Roof Technology. The following four projects are ongoing under this programme:

STRUCTURAL PERFORMANCE OF OPEN GROUND STOREY (OGS) BUILDINGS: GLASS FIBRE REINFORCED GYPSUM (GFRG) BUILDING SYSTEMS VS. CONVENTIONAL RC FRAMED STRUCTURE

Feb. 2015 to Feb. 2018

In the Indian urban context, on account of shortage of land space, parking of vehicles is usually provided in an open ground floor. Typically, this is done in a framed construction, comprising reinforced concrete (RC) columns and beams in all floors, with infill masonry (non-load bearing) walls in all the floors, except in the ground floor. Hence, there is a strong demand from the builder community to extend the Glass Fibre Reinforced Gypsum (GFRG) building system concept to facilitate ground storey parking. This is possible by providing the GFRG wall and floor system supported on a single storeyed RC framed system (with solid RC slab acting as a diaphragm) in the ground floor. The seismic performance of such a vertically irregular structure needs to be thoroughly studied, and experimentally validated, before it can be proposed for wide scale adoption. Even in the case of conventional framed system with open ground storey, the seismic vulnerability is high, as revealed by the Bhuj earthquake in 2001. Following this episode, the seismic code of India addressed this issue in the design, by requiring the ground floor columns to be strengthened and stiffened suitably. In the case of the GFRG building system, a similar strategy may be developed and verified, and compared with the conventional framed system.

Principal Collaborators



Devdas Menon
Indian Institute of Technology-Madras
Chennai



Satish Gunturi
SGRI
Chennai

MUTI-OBJECTIVE OPTIMIZATION OF DAY LIGHTING SYSTEMS

Jan. 2015 to Jan. 2018

The primary goal of this project is to develop day lighting solutions that help in improving the performance of existing buildings. The specific objectives are evaluation of existing solutions for improving lighting, thermal comfort and energy performance of buildings & development of actively controlled lighting and shading devices that are optimized with respect to criteria such as energy, cost and visual comfort. The project would target the retrofit market with special emphasis on affordability.

Principal Collaborators



Benny Raphael
Indian Institute of Technology-Madras
Chennai



Arunvel T
SGRI
Chennai

CONTROLLED EXPERIMENT FOR ESTIMATING THE ENERGY SAVING POTENTIAL AND INDOOR THERMAL COMFORT IMPROVEMENT BY USE OF HIGH ALBEDO SURFACES ON PITCHED CONCRETE ROOFS

Mar. 2015 to Feb., 2017

A roof that reflects and emits the solar radiation back to the sky rather than transferring it into the building is termed as cool roof. Cool roof helps in reducing air conditioning energy consumption in a conditioned building and improves thermal comfort in an unconditioned building. The percentage energy savings achieved in a building from cool roofs is dependent on various parameters such as the location, orientation of the building, local shading by trees or other buildings, construction type, insulation level, plenum ventilation, equipment load, occupancy and operational schedules.

The study would involve using experimental chambers which can mimic a part of a typical residential building. Both these chambers will have pitched roofs. Two such chambers would be used in parallel for this study. The roof of one of the chambers will be regular concrete roof and other one will be coated with a cool roof. The energy consumption in the air conditioning system of both these chambers would be measured. The energy saving potential of cool roof compared to dark roof will be calculated during the conditioned hours. During the unconditioned hours, the change in indoor comfort can be measured.

Principal Collaborators



Vishal Garg

*International Institute of Information Technology – Hyderabad
Hyderabad*



Rathish SA

*SGRI
Chennai*

DEVELOPMENT OF DESIGN GUIDELINES FOR BUILDING ENVELOPE IN TROPICAL CLIMATES

Mar. 2015 to Feb. 2018

The project aims at developing a set of design guidelines for building envelope for minimum energy consumption in the building for space cooling/heating and lighting. This design methodology is specific to tropical climates with special reference to Indian sub-continent. The occupancy classes targeted are large commercial spaces (malls etc.), office buildings, conditioned residential buildings and hotels. The design guidelines will be obtained through an optimization scheme using genetic algorithm (or a hybrid optimization procedure). Using the algorithm already developed, given in the references above, the optimal solution for several cases would be arrived at, with a kind of building façade construction available at the moment. Hence, a survey of currently available wall and roof construction including glasses and skin for fenestration covers for building envelope is required and will be done. The properties of materials in the construction would be taken from available sources. Using the optimization procedure proposed, the best and near best solutions and the values of all decision variables would be obtained for various cases and consolidated to obtain design guidelines for several situations.

Principal Collaborators



B. Bhattacharjee

*Indian Institute of Technology-Delhi
New Delhi*



Vinay Natarajan

*SGRI
Chennai*



Arunvel T

The Airbus Group-CEFIPRA Aerospace Programme

CEFIPRA and the Airbus Group joined hands by signing a MoU on 26th May, 2015 in France to launch “The Airbus Group-CEFIPRA Aerospace Programme”. The areas of interest are (a) Applied Mathematics, Machine Learning and High Performance Computing; (b) Materials and Structures: composite materials based on nanotechnology and also SHM (Structural Health Monitoring) by using NDA (Non Destructive Analysis) methods; (c) Avionics: miniaturization of smart systems based on MEMS/NEMS and in general micro and nanotechnologies. Call for application was launched in July, 2015 and ten pre-proposals received were evaluated & five were recommended for submission as full proposals by the experts committee meeting held on 17th December 2015 at CEFIPRA office, New Delhi. The full proposals which have been received with last date of submission as 28th February, 2016 will be evaluated in a meeting of the joint selection committee in mid- 2016.



6. Analysis of Scientific Activities

Collaborative Scientific Research Programme

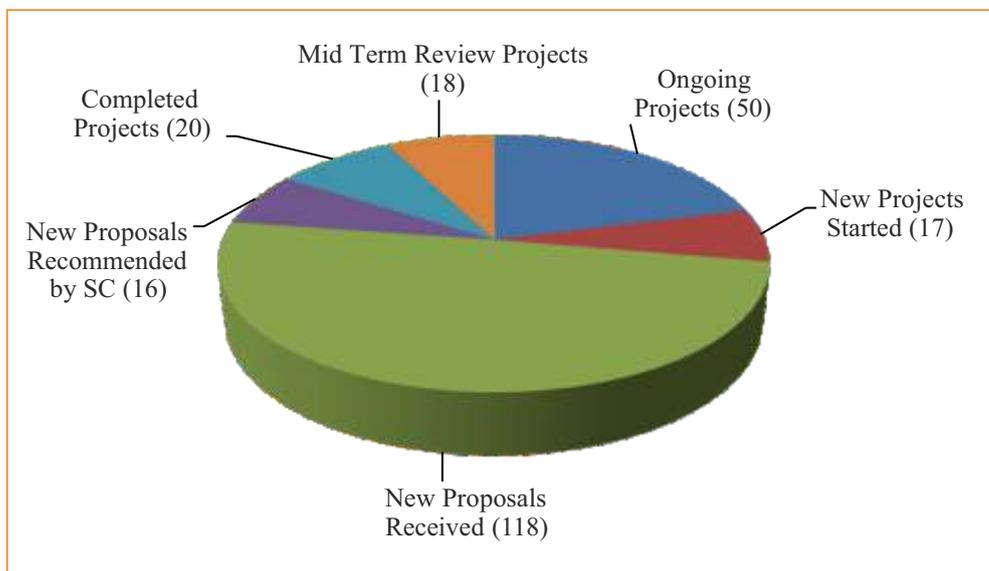


Fig. 1. Status of projects supported during the year under Collaborative Scientific Research Programme

In year 2015-16, seventeen new projects were initiated under the Collaborative Scientific Research Programme of CEFIPRA, while fifty projects were ongoing from the previous years. CEFIPRA received 118 new proposals during the year, which were reviewed and 16 were recommended for support by the Scientific Council in its 55th and 56th meetings. 18 projects underwent for the midterm review and 19 projects were considered for final review.

The thrust area wise distribution of the proposals received and recommended for support during the year 2015-2016 is given in Figures 2 & 3. From the chart it is prominent that the area of life and Health Sciences, Materials Science and Pure and Applied Physics continues to have a higher share of the proposals received and recommended.

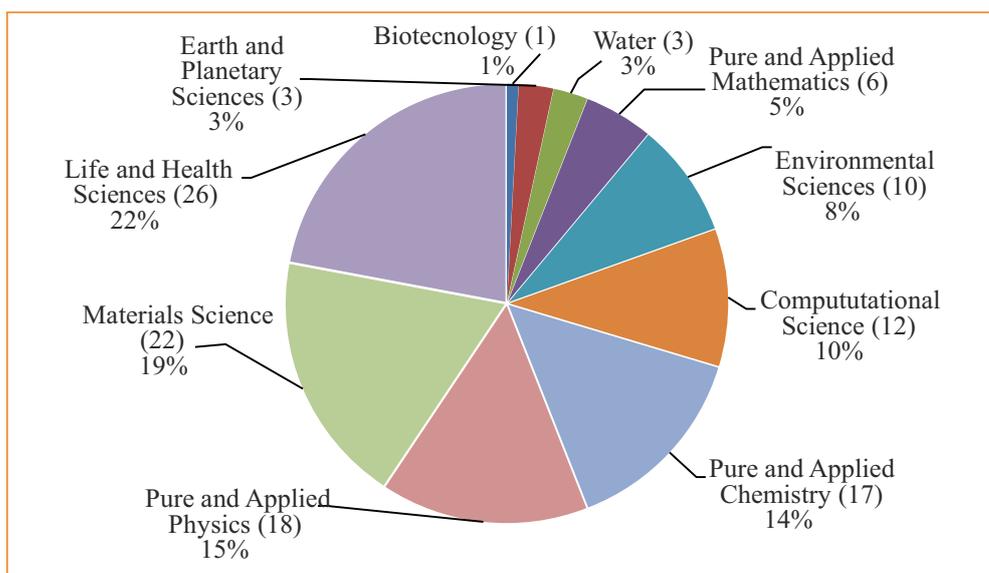


Fig. 2. Area wise distribution of proposals received (Total=118)

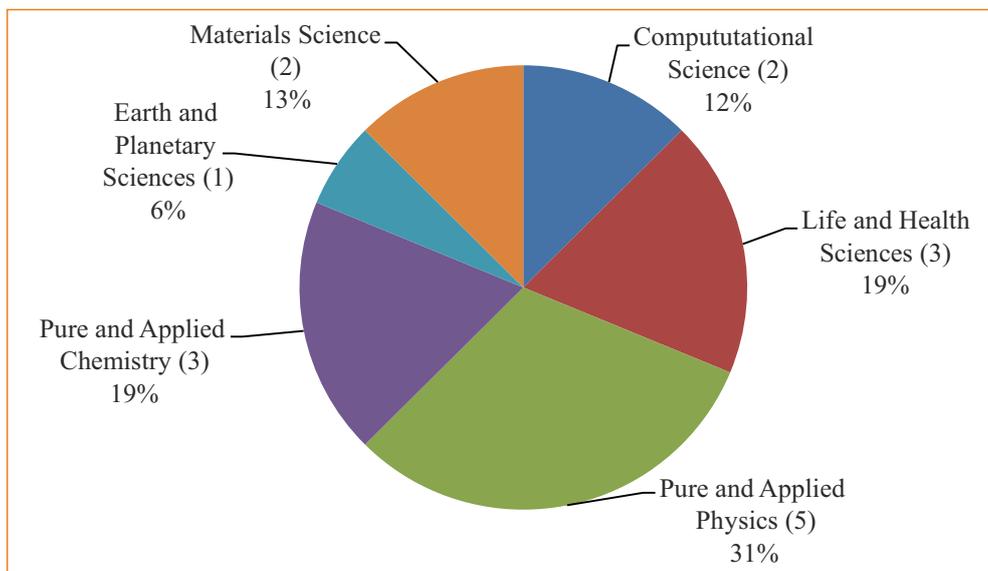


Fig. 3. Area wise distribution of proposals recommended for support (Total=16)

New Projects Commenced: A total of 17 new projects were initiated during the year. Figure 4 depicts the thrust area-wise distribution of projects commenced during the year. The geographical distribution of the projects commenced during the year is given at following pages.

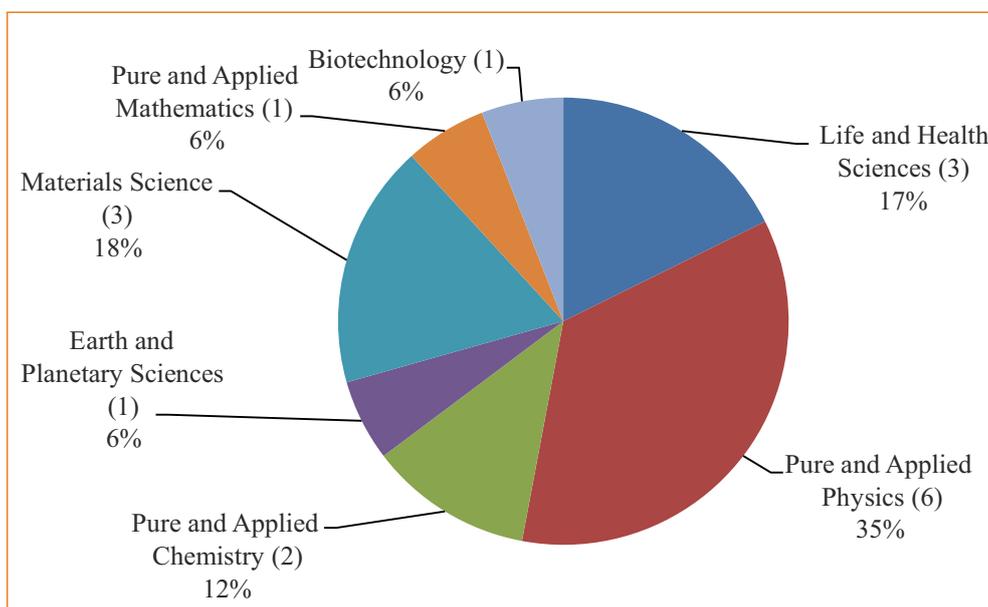


Fig. 4. Area wise distribution of newly initiated projects (Total=17)

Ongoing Projects:

During the year, 50 projects (excluding 17 newly started projects) were continued to be supported under the programme. Figure 5 depicts area wise distribution of 50 projects.

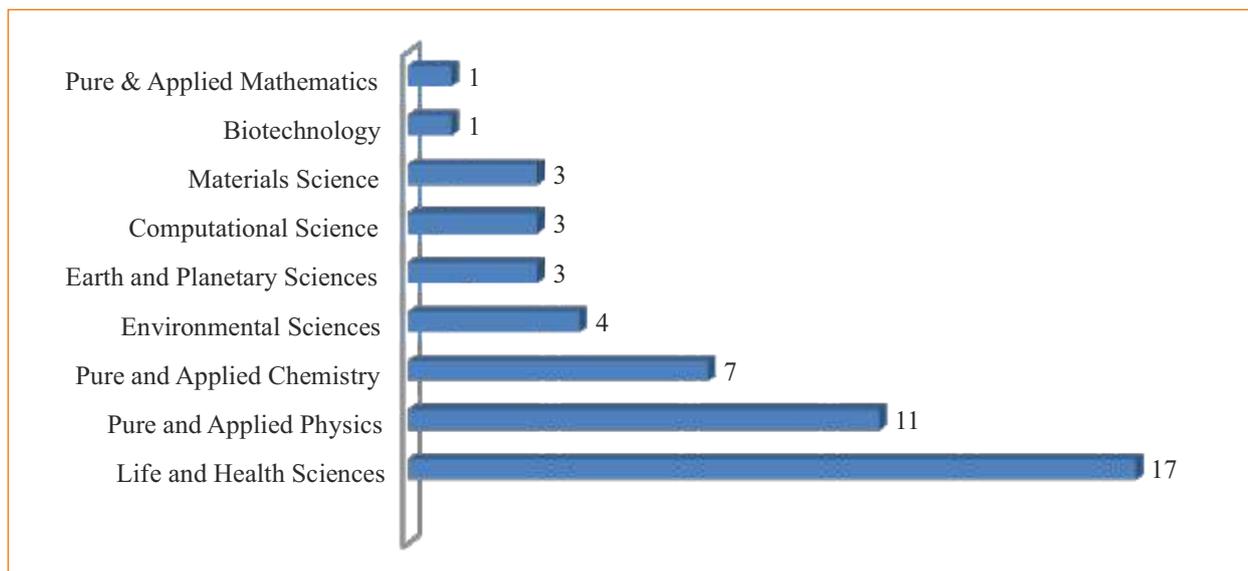


Fig. 5. Area wise distribution of ongoing projects (Total=50)

Completed Projects:

During the year 2015-16, a total number of 20 projects were completed. The performance index shows that 11 projects were rated as ‘Excellent’, 6 as ‘Very Good’ and 3 as ‘Good’ by Scientific Council during final review of the projects. Figure 6 depicts area-wise distribution of 20 completed projects.

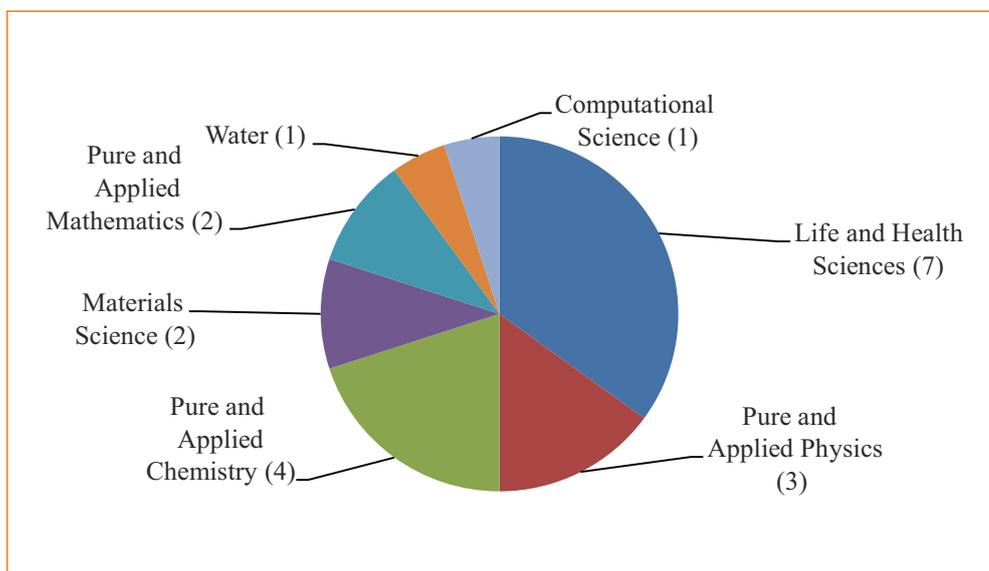


Fig. 6. Area wise distribution of completed projects (Total=20)

The completed projects have resulted in a total of 119 publications. The areas of Pure and Applied Chemistry, Life & Health Sciences, Pure and Applied Physics (Figure 7) are having the highest share of publications. These research publications have been published in reputed peer-reviewed journals; such as ACS Appl Mater Interfaces, Journal of Mater Chem., Journal of Polymer Science, Sedimentary Geology, J Immunol and Cell Host & Microbe, etc. The areas of Life and Health Sciences, Pure and Applied Physics and Pure and Applied Chemistry have received the highest share of citations. The completed projects based on top Average Impact Factor (IF) as per NISCAIR study are given in the following table:

Project	Papers	Sum IF	Avg IF
4508-1	10	70.905	7.091
4603-1	5	33.939	6.788
4803-3	5	26.691	5.338
4503-1	1	4.886	4.886
4705-1	20	85.885	4.294
4803-4	6	25.436	4.239
4705-2	19	75.373	3.967
4704-1	17	62.411	3.671
4608-1	1	2.421	2.421
4500-W1	4	9.241	2.31
4604-2	2	4.179	2.09
4601-2	2	1.025	0.513

Top completed projects based on Average IF (Source; CEFIPRA-NISCAIR Study)

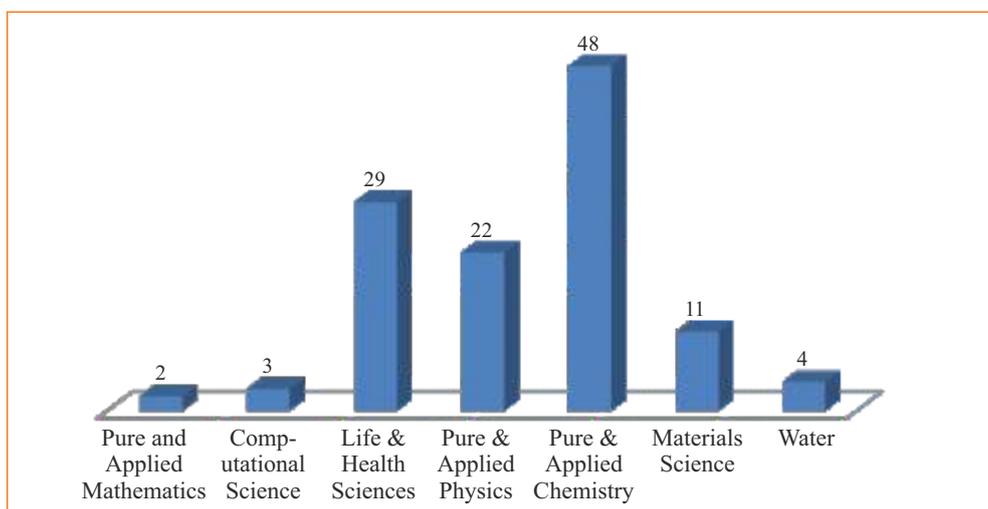


Fig. 7. Number of publication emanated -Thrust area wise

A total of 47 Human Resource (31 in India & 16 in France) comprising of Doctoral and Post-Doctoral students were supported through 20 completed projects. 115 mobility/visits (64 from India to France and 51 from France to India) were also supported. (Figure 8)

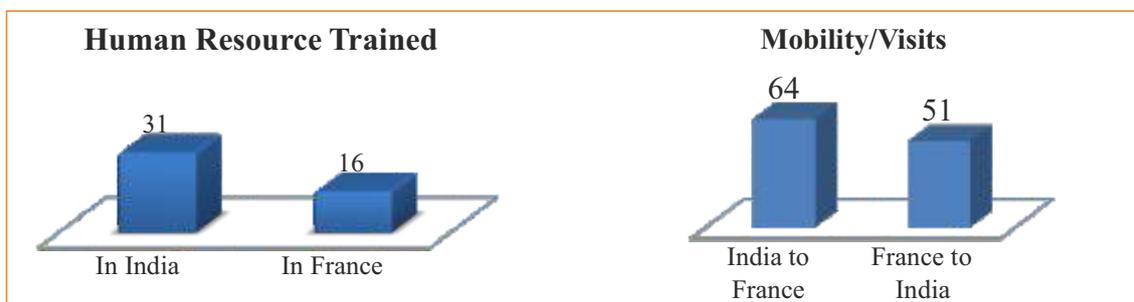


Fig. 8. Outcomes in terms human resource trained and exchange visits under completed projects

Some of the significant knowledge products developed from the 20 completed projects are in the areas of Pure and Applied Chemistry, Environmental Sciences, Information and Communication Technology.

Significant Processes Developed and its Potential for Knowledge Forward Chain Under the Completed Projects

1. Developed new long lasting phosphorescence materials which exhibit Near Infra- Red Persistent Luminescence (NIRPL) even when excited by visible light. With visible light excited NIRPL, the material can be used for in-vivo imaging for as long as it is in the body of the small animal which can be used for optical imaging of vascularisation, tumors and grafted cells (Project No. 4508-1).
2. Developed and tested method for numerical solution of nonlinear acoustics (Project No. 4601-1).
3. Developed and standardized rammed earth specimen size for assessing characteristic compressive strength; Established stress-reduction factors for Cement Stabilised Rammed Earth (CSRE); Developed a shear test device and standardised shear test procedure, evaluated flexural strength and damping and properties of CSRE (Project No. 4608-1).
4. A toolbox in C++ with classical sequence matching algorithms (DTW) has been developed, including two new algorithms as given below:
 - Flexible Sequence Matching (FSM) can operate partial matching inside target by skipping noisy elements (begin, end, and inside target). Many-to-one matching is also allowed to take into account local stretching
 - ESC (Elastic Sequence Cardinality) is an extension of FSM. In addition, it can skip elements in query signal also
 - A two-stage approach for word spotting in graphical documents has been elaborated (for Latin and Indian scripts). It is based on text/graphic separation (using Gabor filters), for recognition of query characters. Missing ones are found in candidate regions based on key points detector (Project No. 4700-IT-1)
5. Several methods were developed to carry out various organic reactions under the catalytic influence of metal-carbon nanotube nanohybrids as efficient heterogeneous catalysts; Novel metal-CNT nanohybrid catalysts were developed and its activity in various organic transformations under very mild conditions such as low catalyst loading, room temperature and open air was investigated (Project No. 4705-1).
6. New state-of-the-art theories (MRCC) at the frontier of electron correlation theories and relativistic quantum chemistry were developed. Developed extensions to the relativistic quantum chemistry package, DIRAC & MRCC theory codes interfaced to DIRAC. The theories and codes developed have vast potential for understanding and predicting molecular spectra and properties (Project No. 4705-3).
7. This is the first time that in vivo pharmacological activation of the HATs CBP/p300 is achieved in the adult mouse, with the conjugation of an activator molecule (TTK21) to a carbon nanosphere (CSP) particle. Pre-clinical studies with CSP-TTK21 HAT activator led in normal and pathological (Alzheimer's model) mice showed a benefic effect on plasticity and memory-related processes, with a clear mode of action defined at the epigenomic and genomic levels. Such molecules - or derivatives - could be of use for bringing cognitive recovery in neurodegenerative diseases. Further improvement in the drug delivery by producing shape-directed nanoparticles able to specify subcellular compartment, will help to carry molecules targeting epigenetic enzyme closer to the gene sites (Project No. 4803-3).
8. Discovery of a new type of superconducting fluctuations with an anomalous dynamics driven by density fluctuations. Representation of experimental evidences of the Cr concentration dependent metal-insulator electronic phase transition at the hetero-interface, explanation is sought within the domain of a polar catastrophe model (Project No. 4704-1).
9. Developed strategies for the preparation of hybrid/composite materials for light-emission or catalysis of organic reactions, in particular the use of metallochololate gels for the room-temperature synthesis of a variety of organic-inorganic composites.; Developed milli-fluidic methodologies using supercritical fluids for the development of new nanoparticles and their production at gram scale; Developed Nanoscale imaging microscopy exploiting the anisotropic emission of single nanorods. The materials, imaging technique and fabrication process can be further developed for potential applications (Project No. 4805-1).

INDUSTRY ACADEMIA RESEARCH & DEVELOPMENT PROGRAMME

Four projects were ongoing during the year and two projects were completed. The area wise distribution of ongoing & completed projects is given in figure 9. The meetings of 26th and 27th Industrial Research Committee (IRC) were held on 1st June, 2015 at Nice, France and 17th November, 2015 at Bangalore, India, respectively. During these meetings the Committee considered twenty concept proposals and recommended eleven, whereas out of four full proposals only two were recommended for support. A total of nine projects underwent for the progress review during these meetings.

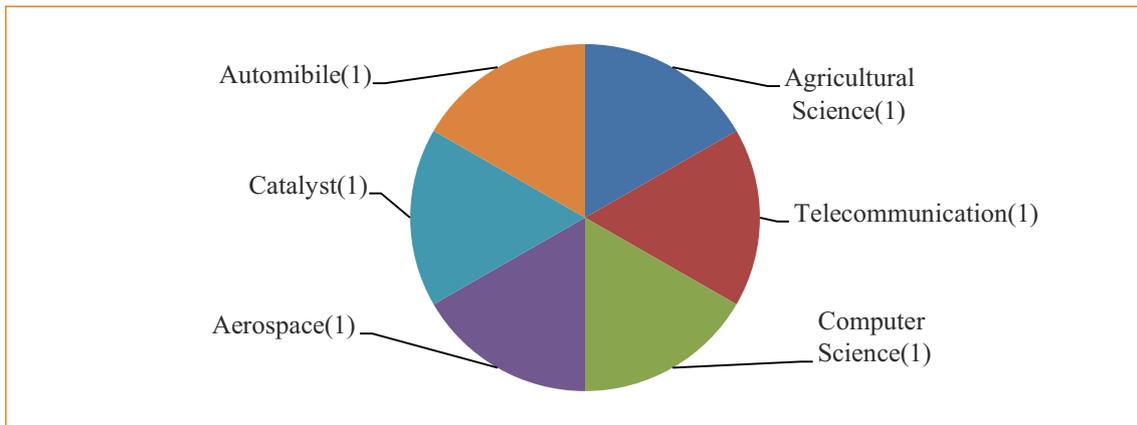


Fig. 9. Area wise distribution for of ongoing & completed projects under Industry-Academia Research and Development Programme

Significant Outcomes

- Mutations of K-Ras and B-Raf in tumor DNA/plasma and urine of colorectal cancers patients in India detected using Intplex methodology from France (Project completed)
- The Long Shelf Life line prototype developed from the project entitled “Tilling in cucurbits: a non-transgenic reverse genetic approach for muskmelon crop improvement” and development of Gynococious line prototype (Project ongoing)
- Publications emanated: 9 in IEEE Transactions on Communications, Journal of Innovation Economics and Management, International Journal of Community Currency Research etc.

NON-CORE PROGRAMMES

Under the non-core programmes, CEFIPRA acted as a facilitator for national funding agencies like Department of Science and Technology and French funding agencies like French National Research Agency (ANR), French National Institute for Agricultural Research (INRA) and French Institute for Research in Computer Science and Automation (INRIA) for collaborative research. The figure 10 depicts the thrust area wise distribution of ongoing projects under the programmes like Targeted Programmes (DST-ANR, DST-INRA, DST-INRIA) BIRAC-CEFIPRA-French Embassy on Health Care Technology and Indo French Water Network.

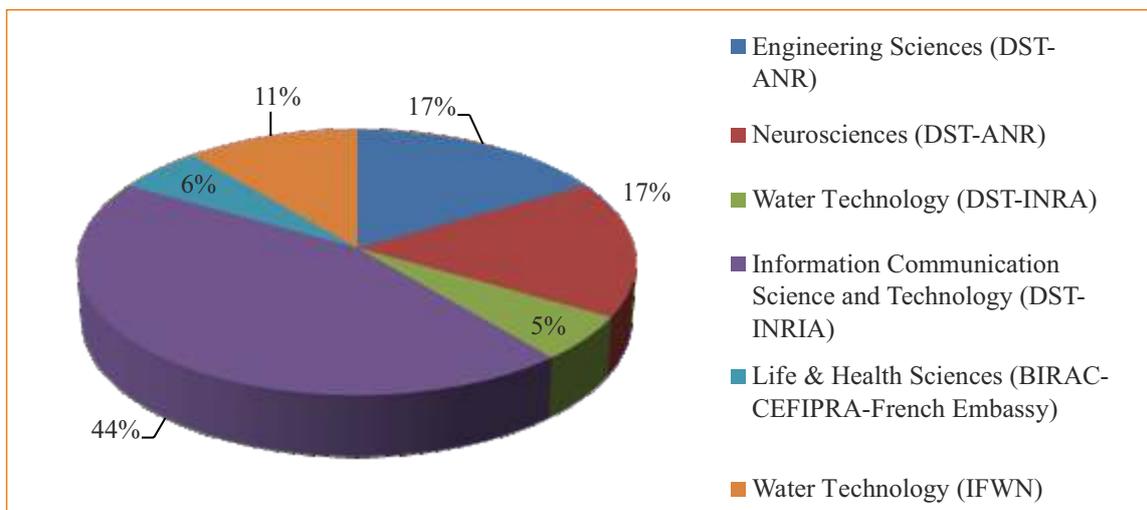


Fig. 10. Area wise distribution of ongoing projects under different non-core

Spatial Aspects of Analysis

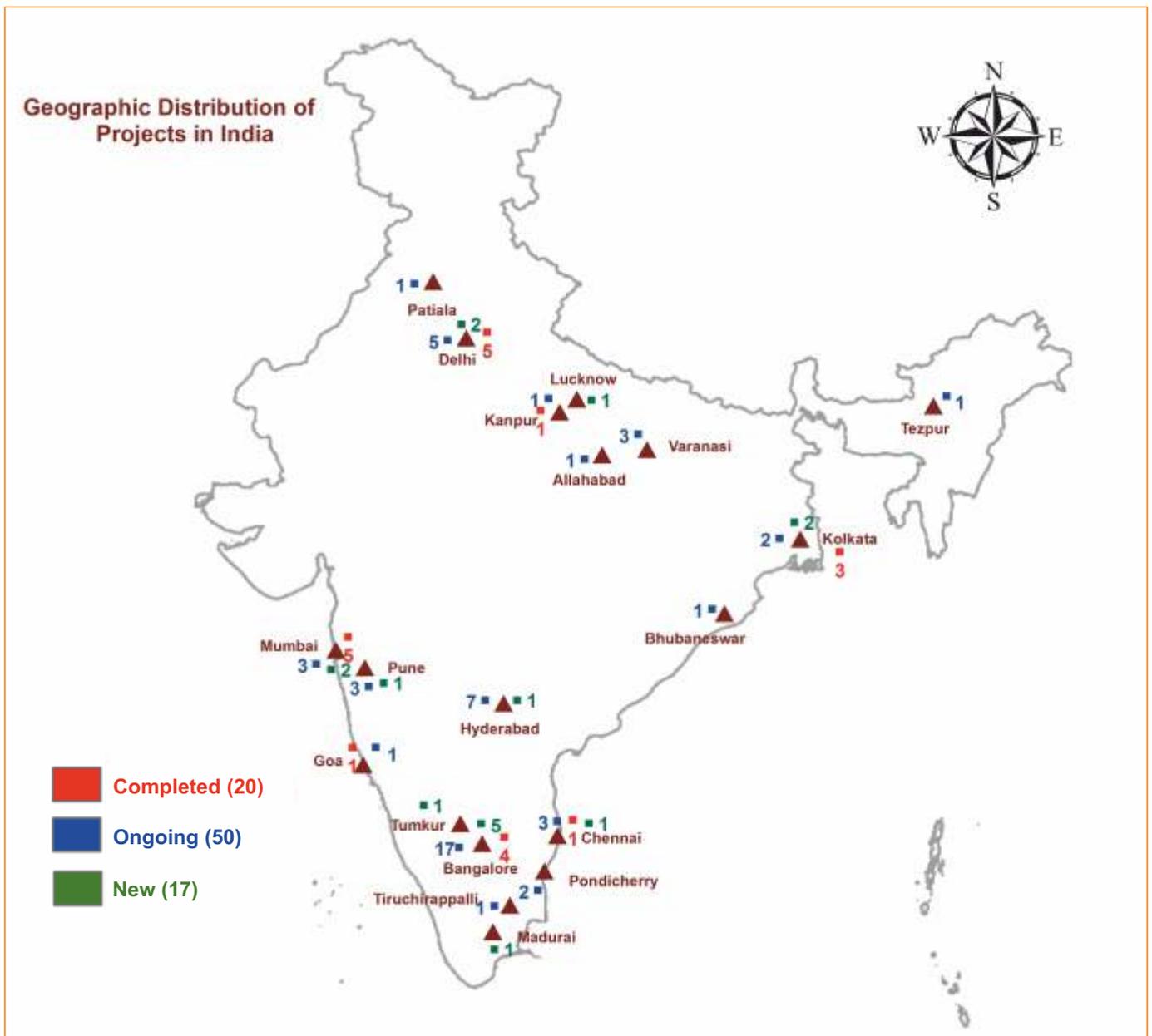
Collaborative Scientific Research Projects of CEFIPRA have an extensive spatial mark across the S&T ecosystem and institutional landscape of India and France.

The maps given ahead capture the heterogeneity of the projects supported by CEFIPRA during 2015-16 in terms of geographical distribution of institutions in India and France.

Below figures show the cities in India and France that have attracted maximum number of Collaborative Scientific Research Projects in both the countries. It can be observed that Bangalore in India and Paris in France have the highest numbers of projects, as compared to the other cities.

Geographic Distribution of Projects in India

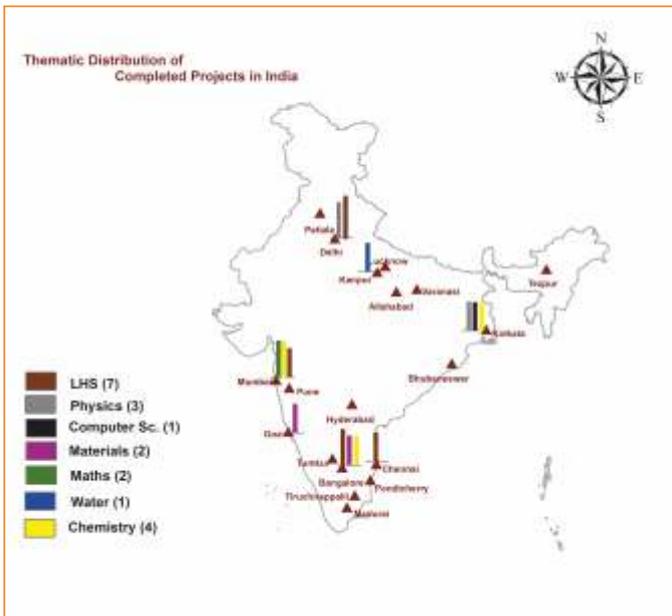
Map 1



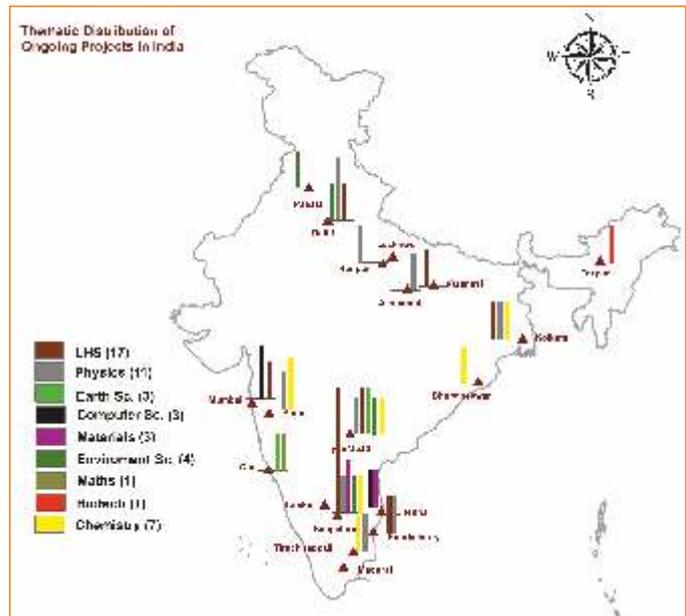
Thematic Distribution of Projects in India

The following three Indian maps showing the spatial heterogeneity with respect to completed ongoing and newly initiated Collaborative Scientific Research Projects of CEFIPRA are in different subject domains.

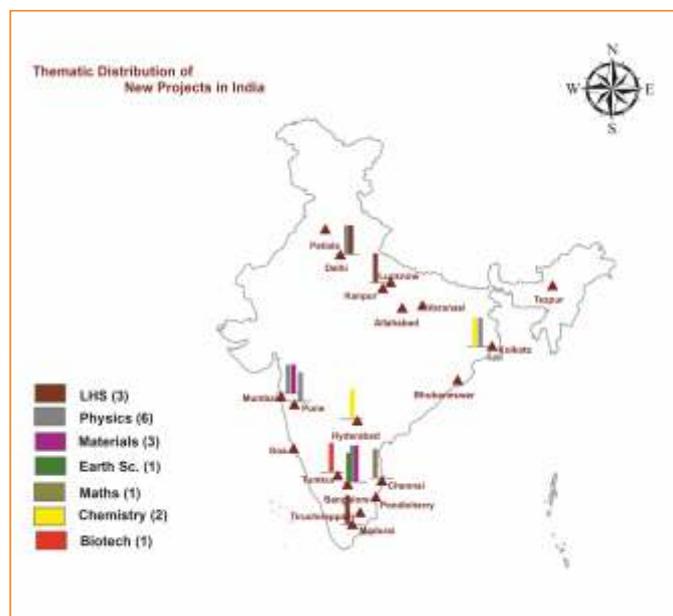
Map 2



Map 3

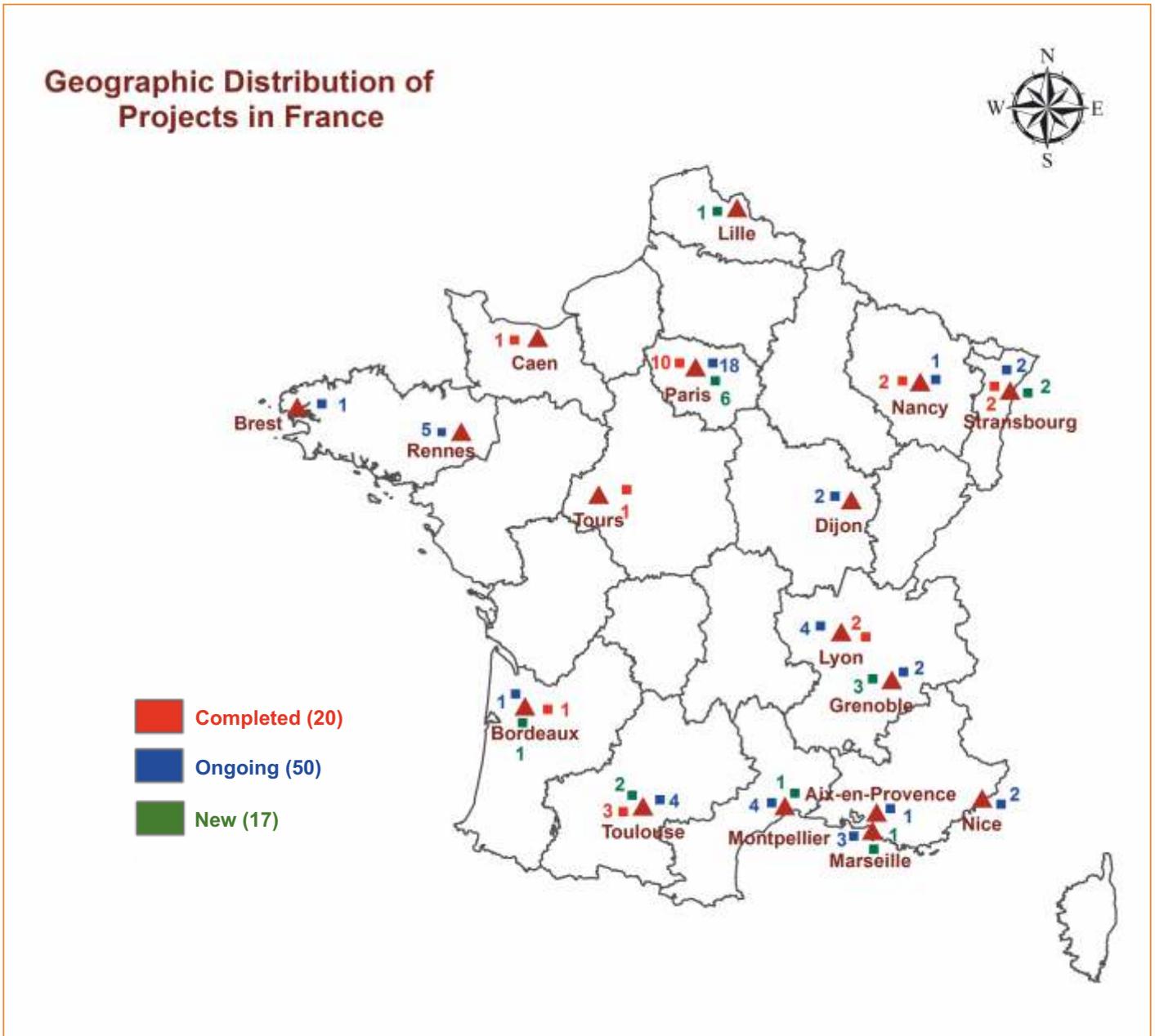


Map 4



Geographic Distribution of Projects in France

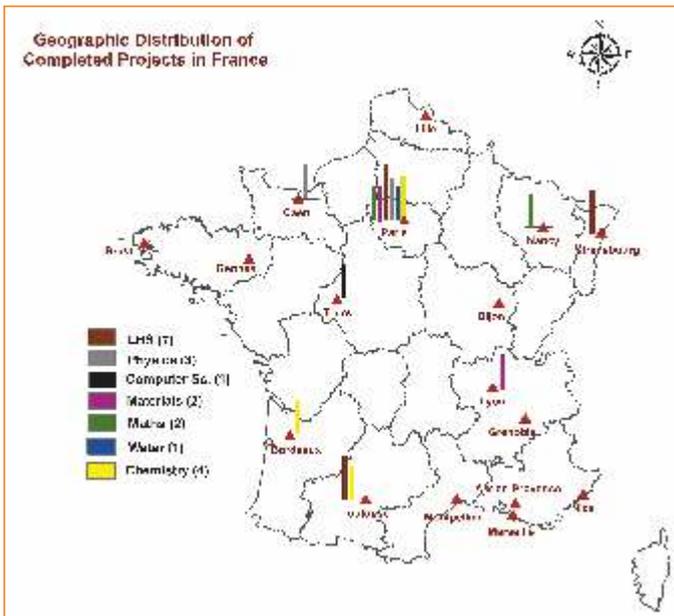
Map 5



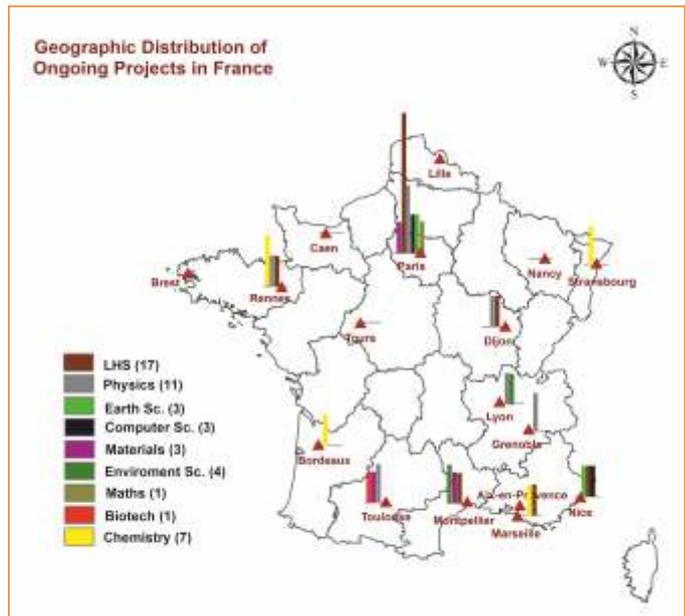
Thematic Distribution of Projects in India

The following three French maps showing the spatial heterogeneity with respect to completed ongoing and newly initiated Collaborative Scientific Research Projects of CEFIPRA are in different subject domains.

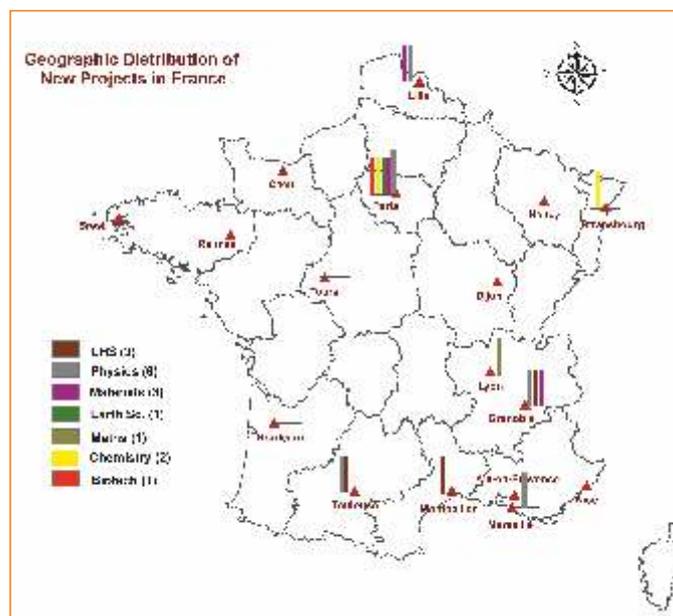
Map 6



Map 7



Map 8





7. Mobility Support to Scientists & Students under Research Projects

Mobility of Scientists & Students

Under Collaborative Scientific Research Programme., CEFIPRA provided support to concerned scientists and students from India and France for exchange visits. The purpose of such visits is to execute and discuss the necessary aspects of work related to scientific research under the project. These visits between the collaborating groups are an important aspect of scientific research projects. These visits are usually intended to carry out a designated set of experiment/s related to the project and can also led to a transfer of experimental material, protocol or methodology and ideas across the participating laboratories. Academic interaction is significantly enhanced by these visits and the researchers/institutions are benefited through these exchange visits in a long run.

In addition, exchange visits also provide an opportunity for cultural exchange. The visits undertaken during the year from April 2015 to March 2016 under this programmes are given below in a tabular form.

Mobility of Scientists Supported Under CEFIPRA Projects April 2015 to March 2016

May- June, 2015			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Analytic aspects of modular forms	Prof. Sengupta Tata Institute of Fundamental Research, Mumbai	Prof. J. Wu University Henri Poincare CNRS –INRIA, Vandœuvre Nancy
2	Influence of the Resorcin[4] arene on the Catalytic Outcomes	Prof. Rengan Ramesh Bharathidasan University, Tiruchirappalli	Dr. D. Sémeril Institut de Chimie de Strasbourg, Strasbourg
3	Analytic aspects of modular forms	Dr. Dipendra Prasad Tata Institute of Fundamental Research, Mumbai	Prof. J. Wu University Henri Poincare CNRS –INRIA, Vandœuvre Nancy
4	Discontinuous Galerkin method for Nonlinear acoustics	Dr. S Baskar Indian Institute of Technology- Bombay, Mumbai	Prof. Régis Marchiano Institut Jean Le Rond d'Alembert, Paris
5	Catecholestrogens in fish reproductive endocrinology	Dr. Moses Inbaraj Madras Christian College, Chennai	Dr. Alexis Fostier Institut National de la Recherche Agronomique, Rennes

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
6	Interstellar and intergalactic medium at high redshift: Reservoir for galaxy formation	Dr. R. Srianand Inter University Centre for Astronomy & Astrophysics Pune	Prof. P. Petitjean Institut d'Astrophysique de Paris, Paris
7	Developing design guidance for rammed earth construction	Dr. K.S.Nanjunda Rao Indian Institute of Science, Bangalore	Dr. Jean-Claude Morel École nationale des travaux publics de l'État (ENTPE), Vaulx en Velin, Lyon
8	Thermo-hydrodynamics of phase-change induced oscillating Taylor bubble flows	Prof. Sameer Khandekar Indian Institute of Technology- Kanpur, Kanpur	Prof. Jocelyn Bonjour Centre de Thermique de Lyon (CETHIL) INSA Lyon, Villeurbanne
9	Two dimensional electron gas physics in oxide heterostructures	Prof. R.C. Budhani National Physical Laboratory, Delhi	Prof. Jérôme Lesueur Laboratoire de Physique et d'Etude des Matériaux, Paris
10	Supra molecular approach to composite materials for advanced technologies	Dr.Cyril Aymonier Université Bordeaux 1, CNRS UMR 5255, Talence	Dr. Uday Maitra Indian Institute of Science, Bangalore
11	Supra molecular approach to composite materials for advanced technologies	Dr. Marre Samuel Université Bordeaux 1, CNRS UMR 5255, Talence	Dr. Uday Maitra Indian Institute of Science, Bangalore
12	Developing design guidance for rammed earth construction	Dr Quoc Bao Bui Ecole National des Travaux Publics de l'Etat, Vaulx-en-Velin	Dr. K.S.Nanjunda Rao Indian Institute of Science, Bangalore
13	Hypergeometric functions: harmonic analysis and representation theory	Prof. Angela Pasquale Laboratoire de Mathématiques et Applications de Metz, Université de Lorraine – Metz	Prof. E. K. Narayanan Indian Institute of Science, Bangalore
14	Molybdenum-containing enzymes: bioinspired peptidic catalysts for CO2 reduction	Prof. Surajit Sinha Indian Association for Cultivation of Science, Kolkata	Dr. Reglier Marius Institut des Sciences Moléculaires de Marseille ISM2 UMR CNRS, Marseille

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
15	sp ³ C-H Bond Activation with Ruthenium(II) Catalysts: Application to the Synthesis of Aliphatic N-Heterocyclic Natural Products	Dr. GVM Sharma CSIR-Indian Institute of Chemical Technology, Hyderabad	Dr. Christian Bruneau UMR6226 : Institut des Sciences Chimiques de Rennes Rennes
16	Magnetic nanoparticles for hyperthermia and spintronics	Prof. Varsha Banerjee Indian Institute of Technology - Delhi New Delhi	Dr. Christian Bruneau Laboratoire de Physique et Chimie des Nano-Objets INSA, Toulouse
17	eSynapse based on heterostructures of binary oxides	Mr. Nandakumar Rajalekshmi Indian Institute of Technology - Bombay Mumbai	Prof. Catherine Dubourdieu Institut des Nanotechnologies de Lyon, CNRS – Ecole Centrale de Lyon Lyon

July- August, 2015			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Studies of spin ladder and heavy fermion systems in extreme conditions of hydrostatic or uniaxial pressure and low temperature	Dr. Arumugam Sonachalam Bharathidasan University, Tiruchirappalli	Prof. Daniel Braithwaite INAC/SPSMS/IMAPEC, CEA Grenoble, Grenoble
2	Hypergeometric functions: harmonic analysis and representation theory	Prof. Angela Pasquale Universit de Lorraine, Metz	Prof. E. K. Narayanan Indian Institute of Science, Bangalore
3	Influence of the Resorcin[4]arene on the Catalytic Outcomes	Dr. David Semeril Université de Strasbourg, Strasbourg	Prof. R. Ramesh Bharathidasan University, Tiruchirappalli
4	Control of melanosome biogenesis by small GTPases	Prof. S. R. Gangi Setty Indian Institute of Science, Bangalore	Prof. Graca Raposo Institut of Curie Centre de Recherche, CNRS UMR144 Paris

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
5	Correlated studies of response properties of Open-shell molecules in the relativistic Framework	Prof. Debashis Mukherjee Indian Association for the Cultivation of Sciences, Kolkata	Prof. Trond Saue Laboratoire de Chimie et Physique Quantiques, Université de Toulouse 3, Toulouse
6	Tropical cyclones in the Bay of Bengal: Oceanic response and air-sea interactions	Dr. Matthieu Lengaigne Laboratoire d'Océanographie et de Climatologie: Experimentation et Analyses Numériques-, Université Pierre et Marie Curie, Paris	Dr. S. Neetu National Institute of Oceanography, Goa

September-October, 2015

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Genome wide recruitment profiling of BLM after DNA damage	Dr. Sagar Sengupta National Institute of Immunology, New Delhi	Prof. Gaëlle Legube Laboratoire de Biologie Moleculaire et Cellulaire du Controle de la Proliferation, Toulouse
2	Tropical cyclones in the Bay of Bengal: Oceanic response and air-sea interactions	Dr. Neetu National Institute of Oceanography, Goa	Dr. Matthieu Lengaigne Laboratoire d'Océanographie et de Climatologie: Experimentation et Analyses Numériques-, Université Pierre et Marie Curie
3	Tropical cyclones in the Bay of Bengal: Oceanic response and air-sea interactions	Ms. Teesha Mathew National Institute of Oceanography, Goa	Dr. Matthieu Lengaigne Laboratoire d'Océanographie et de Climatologie: Experimentation et Analyses Numériques-, Université Pierre et Marie Curie, Paris
4	Novel nanotechnological approaches for treatment of lishmaniasis using 2 propylquinoline	Dr. A. Jayakrishnan Indian Institute of Technology –Madras, Chennai	Dr. Philippe Loiseau Labex LERMIT, Faculté de Pharmacie Université Paris Sud, Paris
5	Novel nanotechnological approaches for treatment of lishmaniasis using 2 propylquinoline	Prof. V Kesavan Indian Institute of Technology –Madras, Chennai	Dr. Philippe Loiseau Labex LERMIT, Faculté de Pharmacie Université Paris Sud, Paris

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
6	Tropical cyclones in the Bay of Bengal: Oceanic response and air-sea interactions	Dr. Matthieu Lengaigne Laboratoire d'Océanographie et de Climatologie: Experimentation et Analyses Numériques, Paris	Dr. Neetu National Institute of Oceanography, Goa
7	Control of melanosome biogenesis by small GTPases	Prof. S. R. Gangi Setty Indian Institute of Science, Bangalore	Prof. Graca Raposo Institut of Curie Centre de Recherche, CNRS UMR144, Paris
8	Development of fulvene-based Zr(II) and Ti(II) chemistry: organometallics, reactivity and applications in organic synthesis	Dr K.V. Radhakrishnan National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Trivandrum	Prof. Jan Szymoniak CNRS UMR 7312, URCA –Faculté des Sciences, Université de Reims, Reims
9	Puzzling properties of Ultrathin polymer films	Prof. Milan Sanyal Saha Institute of Nuclear Physics, Kolkata	Prof. Alain Gibaud UMR 6087 CNRS Bld O. Messiaen, 72085 Le Mans Cedex 09
10	Design and synthesis of new C1-symmetric biaryl-based ligands and catalysts and their evaluation in asymmetric catalytic reactions	Dr. Pradeep Tripathi CSIR- National Chemical Laboratory, Pune	Dr. Frederic Leroux Laboratoire de Chimie Moléculaire, UMR CNRS 7509, COHA-lab, University of Strasbourg, Strasbourg
11	Gene resources from polluted soils	Prof. M.S. Reddy Thapar University, Patiala	Dr. Laurence Fraissinet-Tachet Université Lyon1 UMR CNRS 5557 d'Ecologie Microbienne, Villeurbanne
12	Developing design guidance for rammed earth construction	Dr. K.S.Nanjunda Rao Indian Institute of Science, Bangalore	Dr. Jean-Claude Morel Laboratoire Génie Civil et Bâtiment (LGCB), École nationale des travaux publics de l'État (ENTPE), Vaulx en Velin
13	Supra molecular approach to composite materials for advanced technologies	Dr. Uday Maitra Indian Institute of Science, Bangalore	Prof. André Del Guerzo Institut des Sciences Université de Bordeaux, CNRS UMR5255, Talence

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
14	Thermo-hydrodynamics of phase-change induced oscillating Taylor bubble flows	Prof. Frederic Lefevre Centre de Thermique de Lyon(CETHIL) CETHIL, INSA de Lyon, Villeurbanne	Prof. Sameer Khandekar Indian Institute of Technology- Kanpur, Kanpur
15	Extreme QCD in the LHC Era	Prof. Jean-Yves Ollitrault Institut de physique theorique CEA, Saclay F-91191 Gif-sur-Yvette	Prof. Rajeev S. Bhalerao Tata Institute of Fundamental Research, Mumbai
16	Effect of the correlations in the statics and the dynamics of extended systems	Prof. Alberto Rosso Laboratoire de Physique Théorique et Modèles, Statistiques- Univesité Paris Sud, Orsay	Prof. Sanjib Sabhapandit Raman Research Institute, Bangalore

November-December-2015			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Deep structure of the Indian continent	Prof Jean Paul Institut de Physique du Globe de Paris, Paris	Dr. Ravi Kumar National Geophysical Research Institute, Hyderabad
2	Deep structure of the Indian continent	Prof. Eleonore Stutzmann Institut de Physique du Globe, Paris	Dr. Ravi Kumar National Geophysical Research Institute, Hyderabad
3	Deep structure of the Indian continent	Prof. Veronique Farre Institut de Physique du Globe, Paris	Dr. Ravi Kumar National Geophysical Research Institute, Hyderabad
4	Characterisation of factors that determine the balance between genomic integrity and diversity in <i>Helicobacter pylori</i>	Prof. Pablo Radicella UMR967 INSERM/CEA, Institut de Radiobiologie Cellulaire et Moléculaire Commissariat à l'Energie Atomique, Fontenay-aux-Roses	Prof. D. Narasimha Rao Indian Institute of Science, Bangalore
5	Cenozoic denudation of South India	Dr. Anicet Beauvais CEREGE, Europôle Méditerranéen de l'Arbois, Aix-en-Provence	Prof. M Jayananda University of Hyderabad, Hyderabad
6	Cenozoic denudation of South India	Dr. Dominique Chardon, IRD, University of Toulouse, Toulouse	Prof. M Jayananda University of Hyderabad, Hyderabad

S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
7	Arithmetic circuits computing polynomials	Mr. Guillaume Lagarde ,Institut Mathématiques de Jussieu, Paris	Prof. Meena Mahajan Institute of Mathematical Sciences, Chennai
8	Controlling for upscaling uncertainty in assessment of Forest above ground biomass in the Western Ghats of India	Dr. Pierre Courton Botanique et bioinformatique de l'Architecture des Plantes, Montpellier	Dr. V. K. Dadhwal National Remote Sensing Centre, Hyderabad
9	Controlling for upscaling uncertainty in assessment of Forest above ground biomass in the Western Ghats of India	Dr. Pellissier Raphael AMAP, Botanique et Modelisation de l'Architecture des Plantes et des Vegetations, CIRAD, Montpellier	Dr. V. K. Dadhwal National Remote Sensing Centre, Hyderabad
10	All polymer flexible gas sensors(flexi sensors)	Dr. Mohamed Chehimi Research Director, Interfaces, Traitements, Organisation et Dynamique des Systèmes, Paris	Prof.Dinesh K. Aswal Bhabha Atomic Research Centre, Mumbai
11	Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use there of in memory	Prof. Tapas Kundu Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	Dr. Anne-Laurence Boutillier Laboratoire d'Imagerie et de Neursciences Cognitives, Strasbourg

January –February 2016

S. No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Studies of spin ladder and heavy fermion systems in extreme conditions of hydrostatic or uniaxial pressure and low temperature	Dr. Daniel Braithwaite INAC/SPSMS/IMAPE, CEA, Grenoble	Prof. S. Arumugam Bharathidasan University, Tiruchirappalli

S. No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
2	Olfactory modulation of insect flight	Dr. Ben Houot Centre des Sciences du Goût et de l'Alimentation (CSGA), Dijon	Prof. Gaiti Hasan Tata Institute of Fundamental, Research, Bangalore
3	Holography and its applications	Dr. Harold Erbin Université Pierre et Marie Curie, Paris	Prof. Ashok Sen Harish Chandra University, Allahabad
4	Insights on protein structural and evolutionary dynamics	Prof. Alexandre G. de Brevin INSERM UMR-S 665, DSIMB Univ Paris Diderot National Institute for Blood Transfusion (INTS), Laboratoire d'Excellence GR-Ex, Paris	Prof. Narayanaswamy Srinivasan Indian Institute of Science, Bangalore
5	Self-sorted donor and acceptor self-assembly	Dr. Philippe Jean Mésini Institut Charles Sdron 23, Strasbourg	Prof. Suhrit Ghosh Indian Association for Cultivation of Science, Kolkata
6	Optical soliton propagation in various dielectric nonlinear media	Prof. Patrice Tehofo Dinda Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR 6303 CNRS- Univ. Bourgogne Franche-Comté, Dijon	Prof. K. Porsezian Pondicherry University, Pondicherry
7	Design and synthesis of new C1- symmetric biaryl-based ligands and catalysts and their evaluation in asymmetric catalytic reactions	Dr. Pradeep Kumar Tripathi National Chemical Laboratory, Pune	Dr. Frederic Leroux Laboratoire de Chimie Moleculaire, UMR CNRS 7509, COHA-lab, University of Strasbourg, Strasbourg

March, 2016

S.No.	Project Title	Name & Institute Affiliation(From)	Name & Institute Visited (To)
1	Understanding mechanical size effects in metallic micro wires: synergy between experiments & simulation	Prof. Ludovic Thilly Université de Poitiers, Poitiers	Prof. Atul Chokshi Indian Institute of Science, Bangalore

S.No.	Project Title	Name & Institute Affiliation(From)	Name & Institute Visited (To)
2	Understanding mechanical size effects in metallic micro wires: synergy between experiments & simulation	Prof. Loïc Sirnor Université de Poitiers, Poitiers	Prof. Atul Chokshi Indian Institute of Science, Bangalore
3	Design and synthesis of new C1 symmetric biaryl based ligands and catalysts and their evaluation in asymmetric catalytic reactions	Dr. Armen Panossian Laboratoire de Chimie Moleculaire, UMR CNRS 7509, COHA-lab, University of Strasbourg, Strasbourg	Dr. Pradeep Kumar National Chemical Laboratory, Pune
4	Survey of soil Si pools and contribution of Si fertilization in a sustainable rice cultivation in South India	Dr. Doris Barboni CEREGE, UM 34 Aix Marseille Université, CNRS IRD, Aix en Provence	Dr. N.B. Prakash University of Agricultural Sciences, Bangalore
5	Glycochemical studies of Mycobacterial Arabinomycolate	Dr. Loic Lemiègre Ecole Nationale Supérieure de Chimie de Rennes, Rennes	Dr. Srinivas Hotha Indian Institute of Science Education and Research, Pune
6	Glycochemical studies of Mycobacterial Arabinomycolate	Prof. Thierry Benvegna Ecole Nationale Supérieure de Chimie de Rennes, Rennes	Dr. Srinivas Hotha Indian Institute of Science Education and Research, Pune
7	Glycochemical studies of Mycobacterial Arabinomycolate	Dr. Laurent Legentil Ecole Nationale Supérieure de Chimie de Rennes, Rennes	Dr. Srinivas Hotha Indian Institute of Science Education and Research, Pune
8	Collective migration in the fly nervous system	Dr. Angela Giangrande IGBMC, Illkirch, Strasbourg	Prof. K. Vijayaraghavan National Centre for Biological Science, Bangalore
9	Kinetics and spectroscopy in extreme environments: Applications to Astrophysics and Astrochemistry	Dr. Robert Georges UMR6251 CNRS - Université de Rennes 1, Rennes	Prof. E Arunan Indian Institute of Science, Bangalore

S.No.	Project Title	Name & Institute Affiliation(From)	Name & Institute Visited (To)
10	Kinetics and spectroscopy in extreme environments: Applications to Astrophysics and Astrochemistry	Prof. Ludovic Biennier UMR6251 CNRS - Université de Rennes 1, Rennes	Prof. E Arunan Indian Institute of Science, Bangalore
11	Kinetics and spectroscopy in extreme environments: Applications to Astrophysics and Astrochemistry	Dr. Samir Kassi Laboratoire Interdisciplinaire de Physique, Université de Grenoble 1, Grenoble	Prof. E Arunan Indian Institute of Science, Bangalore
12	Self similar optical patterns in non linear media	Prof. Philippe Grellu Université de Bourgogne UMR CNRS N°6303, Dijon	Prof. K Porsezian Pondicherry University, Pondicherry
13	Effect of correlations in the statics and dynamics extended system	Dr. Sanjib Sabhapandit Raman Research Institute, Bangalore	Prof. Alberto Rosso Laboratoire de Physique Théorique et Modèles Statistiques, Université Paris Sud, Orsay
14	Correlated studies of response properties of open shell molecules in the relativistic framework	Dr. Debashis Mukherjee Indian Association of Cultivation of Science, Kolkata	Prof. Trond Saue Laboratoire de Chimie et Physique Quantiques Université de Toulouse 3 Paul Sabatier, Toulouse
15	Holography and its applications	Mr. Abhishek Chowdhury Harish Chandra Research Institute, Allahabad	Prof. Nicholas Halmagyi Laboratoire de Physique Théorique et Hautes Energies - LPTHE, Paris
16	Molecular study of RH gene variants in Indians	Dr. Swati Kulkarni National Institute of Immunohaematology, Mumbai	Dr. Yann Fichou INSERM UMR 1078 Etablissement Français du Sang – Bretagne, Brest

Mobility of Students Supported Under CEFIPRA Projects April 2015 to March 2016

May- June 2015			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Influence of the Resorcin[4]arene on the Catalytic Outcomes	Mr. Balaji Sundararaman Bharathidasan University, Tiruchirappalli	Dr. D. Sémeril Institut de Chimie de Strasbourg, 4 rue Blaise Pascal, Strasbourg Cedex
2	Magnetic nanoparticles for hyperthermia and spintronics	Mr. Manish Anand Indian Institute of Technology –Delhi, New Delhi	Prof. Julian Carrey Laboratoire de Physique et Chimie des Nano-Objets, INSA, Toulouse

September-October 2015			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Muscle SC self-renewal: A stressful matter?	Ms. Swati Dudhal National Centre for Biological Sciences, TIFR Bangalore	Dr. Ana FERREIRO Faculté de Médecine, Groupe Hospitalier Pitié-Salpêtrière, 105 Boulevard de l'Hôpital INSERM, Paris

November-December 2015			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Rotating and curved boundary-layer instabilities	Mr. K.J. Jose TIFR Centre for Interdisciplinary Sciences, Hyderabad	Prof. Benoit Pier Laboratoire d'Mecanique des Fluides et d'acoustique, Ecole Central de Lyon, France
2	Anti factor H autoantibody associated hemolytic uremic syndrome	Ms. Mamta Puraswani Department of Paediatrics, All India Institute of Medical Sciences, New Delhi	Prof. Marie-Agnès Dragon-Durey, Cordeliers Research Centre, Team 13, Paris
3	eSynapse based on heterostructures of binary oxides	Ms. Minveille Marie Institut des Nanotechnologies de Lyon, CNRS – Ecole Centrale de Lyon, Ecully	Dr. Bipin Rajendran Indian Institute of Technology - Bombay, Mumbai
4	Cenozoic denudation of South India	Ms. Amandine Jean CEREGE, Europôle Méditerranéen de l'Arbois, Aix-en-Provence	Prof. M. Jayananda, University of Hyderabad, Hyderabad

March, 2016			
S.No.	Project Title	Name & Institute Affiliation (From)	Name & Institute Visited (To)
1	Magnetism of self-organized structures at surfaces	Mr. Rishav Harsh Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore	Prof. Sylvie Rousset Universite Paris Diderot, Paris
2	Host-Virus Interactions and Antibody Therapy for Japanese Encephalitis	Ms. Anupama Karnam Indian Institute of Science, Bangalore	Dr. Sebastian Lacroix Desmazes INSERM UMRS 1138, Centre de Recherche des Cordeliers Escalier, Paris



8. Indian and French Organizations

Collaborative Scientific Research Projects

INDIAN ORGANIZATIONS

Indian Institute of Technology	
1	Indian Institute of Technology (Banaras Hindu University)
2	Indian Institute of Technology Bombay
3	Indian Institute of Technology Delhi
4	Indian Institute of Technology Hyderabad
5	Indian Institute of Technology Kanpur
6	Indian Institute of Technology Madras
Universities	
7	Tumkur University
8	Bharathidasan University
9	Shiv Nadar University
10	Tezpur University
11	Thapar University
12	University of Agricultural Sciences
13	University of Calcutta
14	University of Delhi
15	University of Hyderabad
16	Jawaharlal Nehru University
17	Goa University
Other Academic / Research Institutions	
18	Central Drug Research Institute
19	Indian Institute of Chemical Technology
20	National Chemical Laboratory
21	All India Institute of Medical Sciences
22	Bhabha Atomic Research Centre
23	Centre for Cellular and Molecular Biology
24	Centre for DNA Fingerprinting and Diagnostics
25	Harish Chandra Research Institute
26	Indian Association for the Cultivation of Sciences
27	Indian Institute of Science
28	Indian Institute of Science Education and Research
29	Institute of Liver and Biliary Sciences
30	Institute of Mathematical Sciences
31	Inter University Accelerator Centre
32	Inter University Centre for Astronomy and Astrophysics
33	Jawaharlal Institute of Postgraduate Medical Education and Research
34	Jawaharlal Nehru Centre for Advanced Scientific Research
35	National Geophysical Research Institute
36	National Institute for Interdisciplinary Science & Technology
37	National Institute of Immunohaematology
38	National Institute of Immunology
39	National Institute of Oceanography
40	National Physical Laboratory
41	National Remote Sensing Centre
42	Raman Research Institute
43	Tata Institute of Fundamental Research
44	Translational Health Science and Technology Institute
45	PG Institute of Ophthalmology (Aravind Eye Hospitals)
46	Indian Statistical Institute

Industry Academic Research Projects

INDIAN ORGANIZATIONS / INDUSTRIES

1	BenchBio Private Limited	7	Indian Institute of Technology Delhi
2	Delhi Integrated Multi-Modal Transit System Ltd.	8	Namdhari Seeds Private Limited
3	Dhvani Research & Development Solutions	9	National Chemical Laboratory
4	Indian Institute of Science	10	Tata Consultancy Services
5	Indian Institute of Technology Kanpur	11	Tata Institute of Fundamental Research
6	Indian Institute of Technology Madras		

Targeted and Innovation Projects

INDIAN ORGANIZATIONS / INDUSTRIES

1	All India Institute of Medical Sciences	14	Jadavpur University
2	Chennai Mathematical Institute	15	Vellore Institute of Technology University
3	Curadev Pharma Private Limited	16	National Environmental Engineering Research Institute
4	GeNext Genomics (GNG) Private Limited	17	Birla Institute of Technology and Science (Goa Campus)
5	Indian Institute of Science Bangalore	18	National Institute of Technology Karnataka
6	Indian Institute of Technology Bombay	19	Tata Research & Development Jamshedpur
7	Indian Institute of Technology Delhi	20	Venza Water Management Solutions
8	Indian Institute of Technology Madras	21	National Institute for Research in Reproductive Health
9	Indian Institute of Technology Kharagpur	22	M.S. University of Baroda
10	Indian Institute of Technology Roorkee	23	Indian Association for the Cultivation of Science
11	Indraprastha Institute of InformationTechnology Delhi	24	Indian Statistical Institute
12	Indian Institute of Technology Gandhinagar	25	Centre for DNA Fingerprinting and Diagnostics
13	International Institute of InformationTechnology Hyderabad	26	National Centre for Cell Science

Collaborative Scientific Research Projects

FRENCH ORGANIZATIONS

1	Commissariat à l'énergie atomique (CEA)	19	University Pierre and Marie Curie
2	Centre national de la recherche scientifique (CNRS)	20	Université de Poitiers
3	Institut national de la recherche agronomique(INRA)	21	Université de Reims Champagne-Ardenne
4	Institut national de recherche dédié aunumérique (Inria)	22	Université de Rennes
5	Institut national de la santé et de la recherchemédicale (INSERM)	23	Université de Strasbourg
6	Institut National des Sciences Appliquées (INSA)	24	Université de Toulouse
7	Institut Pasteur Paris	25	Université de Rouen
Universities		26	Université Sorbonne
8	Université d'Aix-Marseille	27	Université de Lille
9	Université de Bordeaux	28	Universite Montpellier
10	Université de Bourgogne	29	Université de Rouen
11	Université de Caen	30	Université de Nancy
12	Université de Franche-Comté	31	Université de Montfoulon
13	Université François-Rabelais	32	Université de Luminy
14	Université de Lorraine	33	Universit' de Lorraine - Metz
15	Université de Lyon	Ecole	
16	Université de Nantes	34	Ecole Nationale Supérieure de Chimie de Paris
17	Université Paris Diderot	35	Ecole Centrale de Lyon
18	Université de Paul Sabatier	36	Ecole Nationale Supérieure de Chimie de Rennes
		37	Ecole Polytechnique-Centre de Physique Théorique
		38	Ecole National des Travaux

Industry Academic Research Projects

FRENCH ORGANIZATIONS / INDUSTRIES

1	Airbus Safran Launchers
2	ARKEMA
3	ASTRIUM-ST
4	GEMALTO
5	Alcatel Lucent Bell Labs
6	Telecom Paris Tech, Paris
7	GRETTIA

8	IFSTTAR
9	INRA
10	Inria
11	Université de Bordeaux
12	Université de Lille
13	Université de Nice

Targeted and Innovation Projects

FRENCH ORGANIZATIONS / INDUSTRIES

1	Centre national de la recherche scientifique (CNRS)
2	Centre Interdisciplinaire de Recherche en Biologie (CIRB)
3	Institut national de la recherche agronomique (INRA)
4	Institut national de recherche dédié a numérique (Inria)
5	Institut national de la santé et de la recherche médicale (INSERM)
6	Institut Pasteur
7	Institut Charles Sadron
8	SPAN Diagnostics S.A.R.L.
9	Université Aix- Marseille
10	Université de Bordeaux
11	Université de Cergy-Pontoise

12	Université Paris Diderot
13	Université Paul Sabatier
14	Domaine Universitaire
15	University de La Rochelle
16	Ecole Nationale Supérieure d'Ingénieurs de Poitiers (ENSIP)
17	Université de Rennes 1
18	Université Montpellier 2
19	Technopole de Nancy Brabois
20	Ecoles des Mines de Nantes (EMN), Nantes
21	Company Jean Voisin
22	SAS GENEX



9. Financial Reports & Audited Accounts

Financial Report for FY 2015-16

The CEFIPRA receives grants-in-aid from the Indian and French Governments annually. The nodal agency on the Indian side is the Ministry of Science and Technology and on the French side is the Ministry of Foreign Affairs and International Development. The grants-in-aid are released based on the budgetary projections made by the Centre and duly approved by the Governing Body of the Centre.

a) Core Programmes

The grants-in-aid received from both the Governments are utilized towards expenditure on the following core programmes of the Centre:

- i) Collaborative Scientific Research Programme
- ii) Industry Academia Research and Development Programme
- iii) Seminars/Workshops
- iv) Others (SGRI, ESONN etc.)

During the year 2015-16, Rs.131.88 million (Euro 1.76 million) and Rs. 116.40 million (Euro 1.55 million) grants-in-aid were received from Government of India & Government of France respectively for the core programmes. The details of fund position for the last three years under the core programmes are given below in the **Table 1**

Table 1- Fund Position: grants-in-aid received from Government of India & Government of France for core programmes during the financial years 2013-2014, 2014-2015 & 2015-2016

(Rs. in millions)

Financial Year	Grant-in-aid received from Govt. of India		Grant-in-aid received from Govt. of France		Total Funds available
	C/F from last year	Grant received during the year	C/F from last year	Grant received during the year	
2015-16	1.18	131.88	35.22	116.40	284.68 (Euro 3.79 million)
2014-15	2.00	125.00	36.62	124.41	288.03 (Euro 3.59 million)
2013-14	12.60	110.00	56.39	100.84	279.83 (Euro 4.02 million)

During the year 2015-16, one hundred eighteen new scientific research proposals were received and sixteen proposals were recommended at an estimated cost of Rs. 207.96 million (Euro 2.96 million). As on March 31, 2016, sixty seven

projects were under implementation. These include seventeen new projects which were started during the financial year. The details of expenditure incurred during the year towards core activities are given below:

- i) The core expenditure of the Centre towards collaborative scientific research projects has remained more or less steady between 65 to 70% in the year 2015-16. An amount of Rs. 148.33 million (Euro 1.98 million) was spent on scientific research projects during the year.
- ii) Rs. 12.09 million (Euro 0.16 million) was spent on the Industry Academia Research and Development Programme during the financial year.
- iii) Seminars and workshops have always been used as a platform for enabling interactions between the scientific communities of the two countries. During the year, eleven seminars/workshops were supported by the Centre at a cost of Rs. 14.16 million (Euro 0.19 million).
- iv) In the expanded mandate of CEFIPRA beyond its 25 years, the Centre initiated programme of Public Private Partnership (PPP) with Saint Gobain Research India (SGRI) Ltd. CEFIPRA launched its CEFIPRA-SGRI PPP Programme in 2014-15 and during the FY 2015-16, an amount of Rs. 4.33 million (Euro 0.06 million) was spent.
- v) General scientific expenses of Rs. 8.60 million (Euro 0.11 million) included Rs. 2.18 million (Euro 0.03 million) towards the ESONN programme for supporting the participation of Indian doctoral students to the prestigious European School of Nano-sciences and Nano-technologies-ESONN being implemented by the University of Joseph Fourier (now Universite of Grenoble Alpes), Grenoble.
- vi) Rest of the expenses of Rs. 39.13 million (Euro 0.52 million) are for expense on meetings of Governing Body, Scientific Council and Industrial Research Committee (Rs. 12.52/Euro 0.17 millions) as well as running expenses (Rs. 26.61/Euro 0.35 million).

The details of the expenditure incurred by the Centre during the Financial Year for the core programmes, under various budget heads are given in the **Table 2 and Figure X**. A comparison with the previous three years has also been provided in **Table 2 and Figure Y**.

Table 2: Expenditure incurred for the core programmes during the financial years 2013-2014, 2014-2015 & 2015-2016
(Rs./Euro in millions)

	Budgetary Components	2013-14		2014-15		2015-16	
		Expenditure Rs.	% of total	Expenditure Rs.	% of total	Expenditure Rs.	% of total
1.	Scientific Research Projects	165.84 (2.38 M Euro)	68.75%	178.42 (2.25 M Euro)	69.41%	148.33 (1.98 M Euro)	65.45%
2.	Industrial Research Projects	10.30 (0.14 M Euro)	4.27%	13.31 (0.17 M Euro)	5.18%	12.09 (0.16 M Euro)	5.34%
3.	Seminars & Workshops	22.61 (0.35 M Euro)	9.37%	17.18 (0.22 M Euro)	6.68%	14.16 (0.19 M Euro)	6.25%
4.	PPP Programme (SGRI Projects)	-		4.30 (0.06 M Euro)	1.67%	4.33 (0.06 M Euro)	1.91%
5.	General Scientific Expenses (activities like publication of research papers, short visits of scientists other than project visits, ESONN Programme etc.)	8.85 (0.13 M Euro)	3.67%	7.73 (0.10 M Euro)	3.01%	8.60 (0.11 M Euro)	3.79%
6.	Governing Body, Industrial Research Committee & Scientific Council meetings	12.82 (0.18 M Euro)	5.32%	11.13 (0.14 M Euro)	4.33%	12.52*** (0.17 M Euro)	5.52%
7.	Running expenses of the Centre (Salaries, Office maintenance & Travel)	20.79 (0.29 M Euro)	8.62%	25.34 * (0.31 M Euro)	9.72%	26.61** (0.35 M Euro)	11.74% -** = 8.85%
	TOTAL	241.21 (3.47M Euro) @ 1 Euro = Rs. 69.5438		257.41 (3.25 M Euro) @ 1 Euro = Rs. 79.2000		226.64 (3.02 M Euro) @ 1 Euro = Rs. 75.0955	

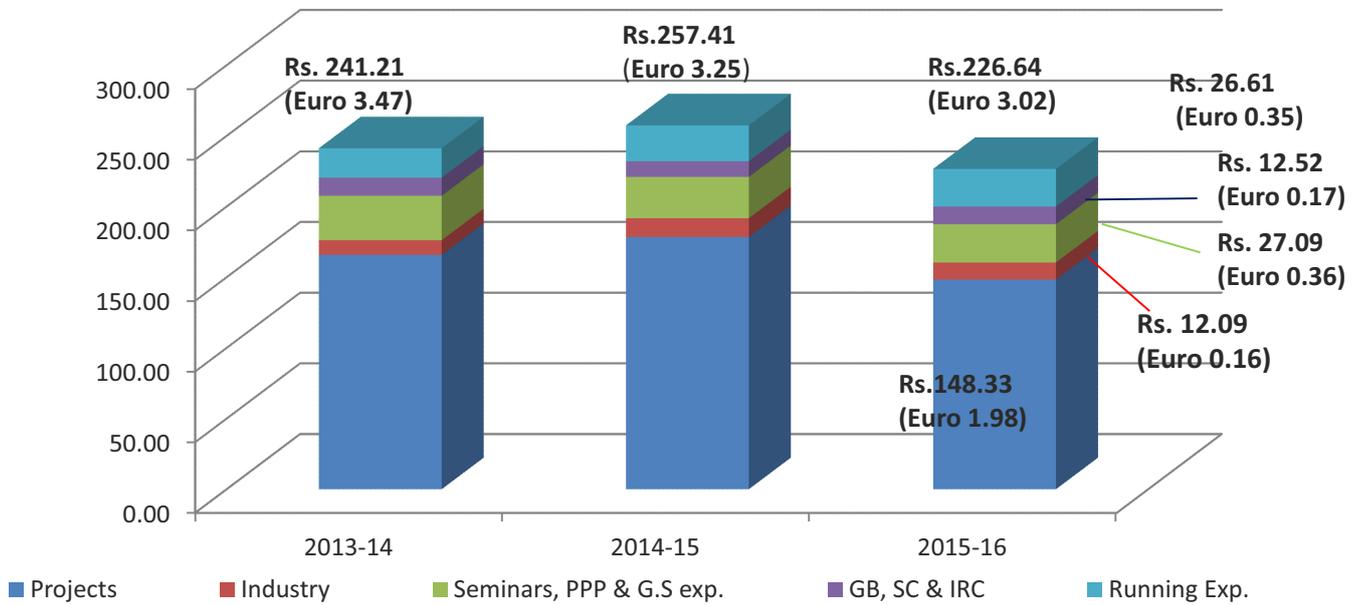
* 1) Excludes expenses of Rs. 7.06 million (Euro 85.984) in FY 2014-15 incurred towards renovation of the Centre.

* 2) Increase due to upgradation of communication and leased line for internet, increase in legal and other expense and liability provision for expenses made due to change over to mercantile system.

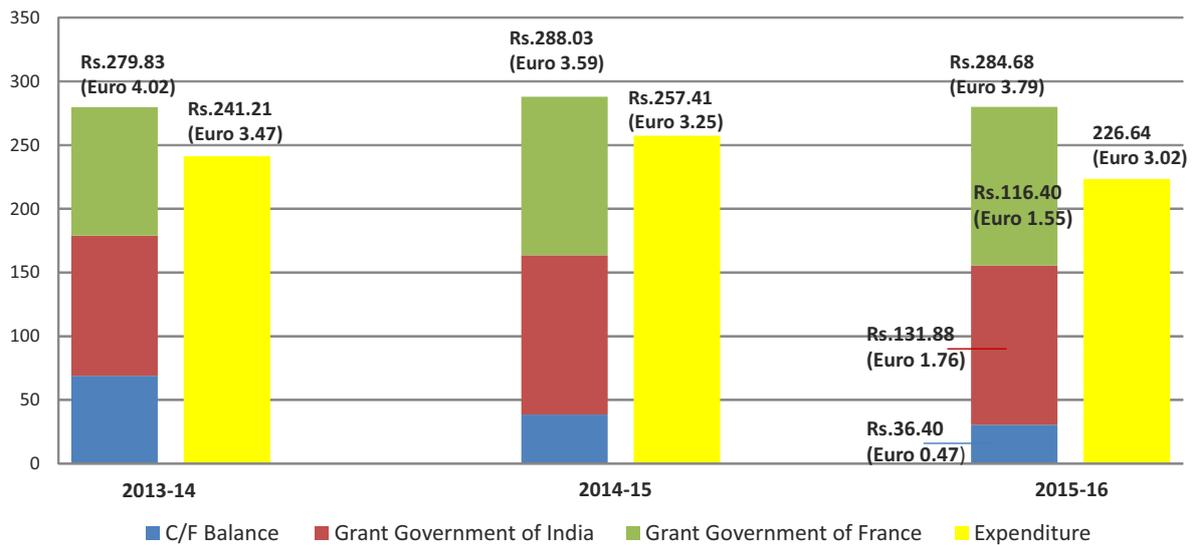
** 1) Increase due to one-time expenditure of Rs. 2.60 million towards recruitment of Director, CEFIPRA, Rs. 1.37 million towards expenses incurred on "Project Proposal Management System" grouped under Office expenses and Rs. 2.59 million paid to LIC towards Pension Contribution for the FYs 2013-14 & 2014-15 (2.89%).

*** 1) Increase due to two meetings of the Governing Body held during the FY 2015-16 (April 2015 & March 2016).

**Figure X : Annual Expenditure Over the Years - Core Programmes
(Rs./Euro in millions)**



**Figure Y : Fund Position vs Expenditure - Core Programmes
(Rs./Euro in millions)**



b) Non-Core Programmes

As per earlier directives of the Governing Body of CEFIPRA, the Centre has initiated its activities for expansion beyond the core programmes and has undertaken a number of new scientific programmes, which are being

funded by various organizations from India and France. The details of fund position and expenditure incurred for the non-core programmes during the financial year 2015-16 are given in the **Table 3 & Figure Z**

Table 3 - Non-Core Programmes: Fund Position & Expenditure incurred during FY 2015-16

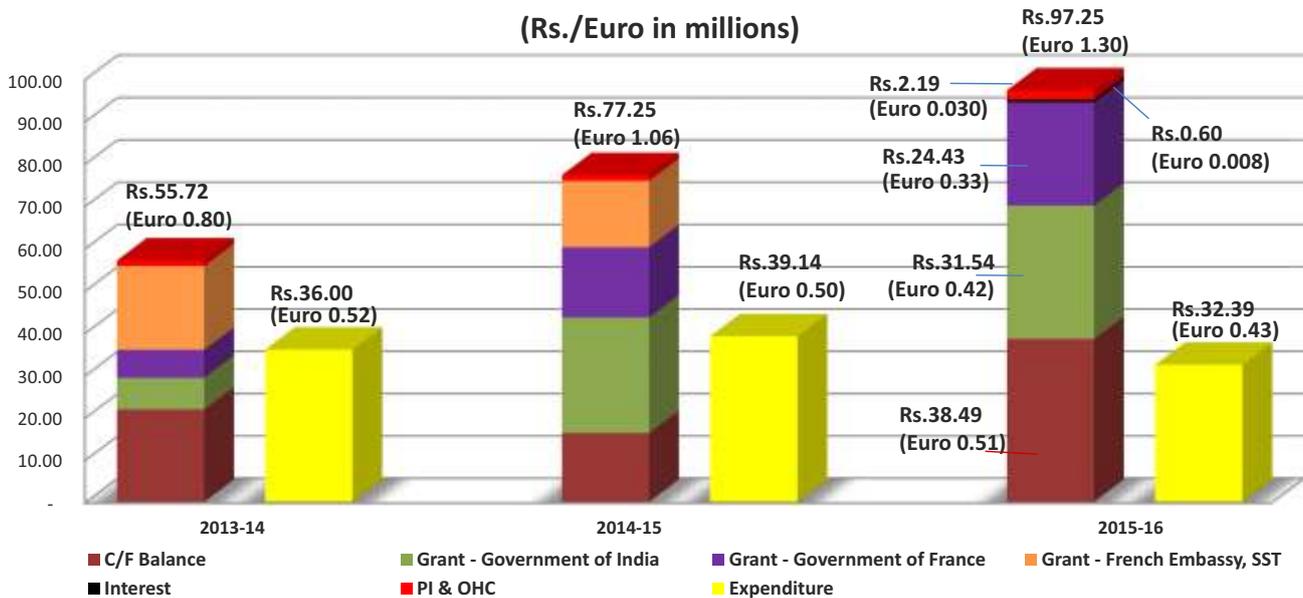
(Rs. in millions)

Non Core Programmes : Fund Position & Expenditure incurred during Financial Year 2015-16										
S.No.	Funds Available		Received during the year			Total funds available during the year (a)	Expenditure during the year		Total Expenditure (b)	Balance Available (a-b)
	RECEIPTS	C/F Balance	Indian Side	French Side	Interest Earned on Indian		Indian Side	French Side		
1	IFCAM (DST-CNRS)	2.65	11.59	3.04	0.10	17.38	8.50	-	8.50	8.88
2	RAMAN CHARPAK FELLOWSHIP(DST-Fr.Embassy)	7.62	5.46	10.14	0.30	23.52	3.24	4.65	7.89	15.63
3	DST-INRA PROJECTS	5.58	-	-	0.10	5.68	2.36	-	2.36	3.32
4	DST-Inria-CNRS PROJECTS	0.05	6.83	-	-	6.88	4.36	-	4.36	2.52
5	DST-ANR PROJECTS	0.35	5.00	-	0.10	5.45	3.62	-	3.62	1.83
6	BIRAC- FRENCH EMBASSY PROJECTS	6.87	-	9.00	-	15.87	1.95	1.80	3.75	12.12
7	Indo-French Water Network	1.11	4.85	2.25	-	8.21	0.04	0.11	0.15	8.06
8	FRENCH EMBASSY(SST)	14.26	-	-	-	14.26	1.46	0.30	1.76	12.50
	TOTAL	38.49	33.73	24.43	0.60	97.25	25.53	6.86	32.39	64.86

NOTE:

- (1) Expenditure in Raman Charpak Fellowship includes committed expenditure of Euro 59249.58 @ 75.0955 Rs. 4.45 million on French side and Rs. 2 million on Indian side.
- (2) The C/F balances includes interest earned in the FY 2014-15.
- (3) The grants received from Indian side and French side (IFCAM and Raman Charpak) includes Programme Implementation and Overhead Charges.
- (4) Programme Implementation and Overhead Charges received in Euro for IFCAM, Rs 1,12,643/- (Euro 1500) and Raman Charpak, Rs 4,62,339/- (Euro 6156.68) were repatriated to India. Hence, these have been added to INR grant and same has been reduced from French side grant.
- (5) The closing balance includes Programme Implementation and Overhead Charges.

Figure Z : Fund Position vs Expenditure - Non Core Programmes and Extramural Activities (Rs./Euro in millions)



Financial Audit

The statutory audit of the accounts of the Centre was carried out by M/s. SSAS & Associates, Chartered Accountants, D-147, Pushpanjali Enclave, Pitampura, Delhi 110034. The accounting currency of the Society is Indian Rupee (INR) and Euro. Separate books of accounts are maintained for recording respective transactions occurring in INR and Euro currencies and accordingly separate Financial Statements i.e. Balance Sheet, Income & Expenditure and Receipt and Payment are drawn in respective currencies.

For presentation of consolidated accounts, revenue and expenditure of Euro version in Receipt & Payment and Income & Expenditure accounts and Assets and Liabilities are converted to INR and vice versa on the basis of conversion rate declared by RBI on the Balance Sheet date i.e. 31.03.2016.

The Auditors' Report with its attachments viz. Receipt & Payment Account, Income & Expenditure Account and Balance Sheet in terms of INR and Euro are given in the following pages.

Annual Accounts for the FY 2015-16

The Audited Financial Statements for FY ending on 31.03.2016 are comprising of the following:-

- Auditor's Report
- Balance Sheet as on 31st March, 2016 (in INR and Euro)
- Income & Expenditure Account for the FY (in INR and Euro)
- Receipt & Payment Account for the FY (in INR and Euro)
- Schedules to Balance Sheet, Income & Expenditure Account and Receipt & Payment Account
- Accounting Policies and Notes on Accounts
- Receipt and Payment Account in respect of IFCPAR Gratuity Fund

SSAS & Associates

CHARTERED ACCOUNTANTS

D-147, Pushpanjali Enclave Pitampura, Delhi-110034

Tel: 91.11. 27010841; 91.9868144009, Email: sansaxonline@gmail.com

Date : 30.9.2016

INDEPENDENT AUDITOR'S REPORT

To the Governing Body of
Indo-French Centre for the Promotion of Advanced Research (IFCPAR)
Lodhi Road, New Delhi

Report on Financial Statements

We have audited the accompanying financial statements Indo Indo-French Centre for the Promotion of Advanced Research, New Delhi (a society registered under Societies Registration Act, 1860) which comprise the Balance Sheet as at March 31, 2016, the Income and Expenditure Account, the Receipts and Payments Account for the year then ended and a summary of significant accounting policies and other explanatory information.

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 of the Society. This responsibility includes the design, implementation and maintenance of internal control relevant to the 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 the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of



the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Society's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on effectiveness of the society's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

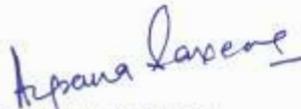
Opinion

In our opinion and to the best of our information and according to the explanations given to us, the accompanying financial statements give a true and fair view of the financial position of Indo French Centre for the Promotion of Advanced Research (IFCPAR) for the year ended March 31, 2016 in conformity with the accounting principles generally accepted in India.

for SSAS & ASSOCIATES,

Chartered Accountants

Firm Registration No: 08550N



ALPANA SAXENA

Partner, Membership No. 095837

Place : Delhi



INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI
BALANCE SHEET AS ON 31ST MARCH, 2016

		Amount as on 31st March, 2016					Amount as on 31st March, 2015	
	SCH	Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	(Conversion Factor 1 Euro = Rs. 75.0955)		(Conversion Factor 1 Euro = Rs. 67.011)	
					Total Transaction converted in Rs	Total Transaction converted in Euro	Total Transaction converted in Rs	Total Transaction converted in Euro
I. Liabilities								
1) Reserve Fund								
a) Core Programmes	A	7,38,15,502.00	5,07,627.94	3,24,98,900.00	10,63,14,402.00	14,15,723.00	10,25,41,557.00	11,08,157.00
b) Non Core Programmes and Extra Mural Activities	B	2,04,02,408.00	6,02,612.86	4,22,72,972.00	6,26,75,380.00	8,34,609.00	3,84,88,556.00	5,74,361.00
2) Current Liabilities								
a) Expenses Payable		7,90,476.00	-	-	7,90,476.00	10,526.00	8,36,388.00	12,481.00
b) TDS & Work Contract Payable		45,470.00	-	-	45,470.00	605.00	1,40,945.00	2,103.00
c) Seminar & Workshop		7,63,400.00	3,820.00	2,86,865.00	10,50,265.00	13,986.00	79,42,535.00	1,18,526.00
d) TA/DA Payable		-	-	-	-	-	-	-
e) BRICS Meeting		51,411.00	-	-	51,411.00	685.00	-	-
f) SC/IRC Meetings		12,50,000.00	-	-	12,50,000.00	16,645.00	27,50,000.00	41,038.00
3) Foreign Currency Adjustment Account		-	-	86,02,216.00	86,02,216.00	1,14,550.00	-	-
TOTAL		9,71,18,667.00	11,14,060.80	8,36,60,953.00	18,07,79,620.00	24,07,329.00	15,26,99,981.00	18,56,666.00
II. Assets								
1) Fixed Assets								
	C	66,07,024.00	-	-	66,07,024.00	87,982.00	79,15,242.00	1,09,884.00
2) Cash & Cash Equivalents								
Core Bank Balances								
a) State Bank of Hyderabad Account		5,60,86,204.00	-	-	5,60,86,204.00	7,46,865.00	2,05,71,041.00	3,06,980.00
b) Union Bank of India		3,91,844.00	-	-	3,91,844.00	5,218.00	3,76,628.00	5,620.00
c) Axis Bank Account		7,31,804.00	-	-	7,31,804.00	9,745.00	6,75,735.00	10,084.00
d) State Bank of Hyderabad (Gratuity) Account		22,32,233.00	-	-	22,32,233.00	29,725.00	22,32,233.00	33,311.00
e) CIC, Paris Account		-	10,64,038.12	7,99,04,475.00	7,99,04,475.00	10,64,038.00	7,24,00,360.00	10,80,425.00
Non Core Bank Balances								
f) Union Bank of India - Raman Charpak Account		80,41,970.00	-	-	80,41,970.00	1,07,090.00	61,68,689.00	92,055.00
g) Union Bank of India - DST INRIA Account		27,15,695.00	-	-	27,15,695.00	36,163.00	2,91,140.00	4,345.00
h) Union Bank of India - DST INRA Account		7,10,582.00	-	-	7,10,582.00	9,462.00	25,24,445.00	37,672.00
i) Union Bank of India - IPCAM Account		65,31,507.00	-	-	65,31,507.00	86,976.00	40,39,306.00	60,278.00
j) Union Bank of India - DST ANR Account		21,55,217.00	-	-	21,55,217.00	28,700.00	7,47,245.00	11,151.00
3) Current Assets								
a) Seminars & Workshops		25,39,200.00	-	-	25,39,200.00	33,813.00	76,41,288.00	1,14,030.00
b) Income Tax & TDS Receivable		46,18,039.00	-	-	46,18,039.00	61,496.00	43,71,719.00	65,239.00
c) Cash in Hand		12,581.00	-	-	12,581.00	167.00	-	-
d) Other Deposits		1,04,267.00	-	-	1,04,267.00	1,388.00	1,19,845.00	1,788.00
e) SC/IRC Meetings		-	-	-	-	-	21,49,990.00	32,084.00
f) Tour Advances		36,40,520.00	50,022.68	37,56,478.00	73,96,998.00	98,501.00	9,65,997.00	14,415.00
g) Interest Accrued		-	-	-	-	-	6,99,904.00	10,446.00
4) Foreign Currency Adjustment Account		-	-	-	-	-	1,88,09,174.00	1,33,141.00
TOTAL		9,71,18,667.00	11,14,060.80	8,36,60,953.00	18,07,79,620.00	24,07,329.00	15,26,99,981.00	18,56,666.00
Accounting policies and notes on accounts	I							

As per our report of even date.
For **SSAS AND ASSOCIATES**
Firm Registration No. 08550N
Chartered Accountants

Alpana Saxena
ALPANA SAXENA
Partner
Membership No. 095837
Place : New Delhi
Date : 30.09.2016



Pranav
PRANAV SHARMA
ASSISTANT ACCOUNTS OFFICER

Mathew
MATHEW JOSEPH
ACCOUNTS OFFICER

Mukesh Kumar
DR. MUKESH KUMAR
DIRECTOR

INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI
INCOME AND EXPENDITURE ACCOUNT OF CORE PROGRAMME FOR THE YEAR ENDED 31ST MARCH 2016 AND FOR THE YEAR 31ST MARCH, 2015

	SCH	Amount as on 31st March, 2016				Amount as on 31st March, 2015		
		(Conversion Factor 1 Euro = Rs. 75.0955)				Quarterly rates		
		Transaction in INR	Transaction in Euro	Euro Transaction converted in INR	Total Transaction converted in INR	Total Transaction converted in Euro	Total Transaction in Rs	Total Transaction in Euro
I. INCOME								
1. Grant-in-aid								
a) Grant from Dept. of Science & Technology, Govt. of India		13,18,81,192.00	-	-	13,18,81,192.00	17,56,180.00	12,50,00,000.00	15,81,743.00
b) Grant from Govt. of France		-	15,50,000.00	11,63,98,025.00	11,63,98,025.00	15,50,000.00	12,44,11,460.00	15,50,000.00
c) BRICS Meeting		2,34,500.00	-	-	2,34,500.00	3,123.00	-	-
d) Grant from Govt. of France-Group Farming		-	6,177.00	4,63,865.00	4,63,865.00	6,177.00	-	-
2. Grant-in-aid-Non Core Programmes & Extra Mural Activities								
a) Grant from Dept. of Science & Technology, Govt. of India		-	-	-	-	-	2,93,28,486.00	3,71,641.00
b) Grant from Govt. of France		-	-	-	-	-	3,22,85,700.00	3,94,166.00
3. Interest from Bank Accounts								
a) State Bank of Hyderabad		9,58,640.00	-	-	9,58,640.00	12,766.00	9,27,840.00	11,720.00
b) UBI-Bank		15,216.00	-	-	15,216.00	203.00	14,625.00	191.00
c) Axis Bank		28,631.00	-	-	28,631.00	381.00	-	-
d) State Bank of Hyderabad-Gratuity Account		-	-	-	-	-	90,556.00	1,182.00
e) Interest Accrued		-	-	-	-	-	7,77,710.00	10,153.00
f) UBI Bank -Non Core programmes		-	-	-	-	-	5,52,984.00	7,218.00
4. Misc Income								
		50,769.00	-	-	50,769.00	676.00	57,598.00	717.00
5. Programme Implementation & Overhead Charges received for Non Core Programmes								
		16,12,339.00	7,656.68	5,74,982.00	21,87,321.00	29,127.00	-	-
6. Repatriation of Funds- Core Fund								
		2,85,29,017.00	(3,92,343.32)	(2,94,63,218.00)	-	-	-	-
7. Repatriation of Funds- Programme Implementation & Overheads Charges								
		5,74,982.00	(7,656.68)	(5,74,982.00)	-	-	-	-
8. Gain/(Loss) on repatriation								
		-	-	-	(9,34,201.00)	(12,440.00)	-	-
9. Exchange Rate Fluctuation								
		-	-	1,80,014.00	1,80,014.00	2,397.00	-	-
10. Rounding Off Difference								
		-	-	-	-	3.00	-	-
11. Brought forward Accumulated Reserves for Specific Programmes								
		-	-	-	-	-	2,31,53,087.00	2,79,886.00
TOTAL		16,38,85,286.00	11,63,833.68	6,75,78,686.00	25,14,63,972.00	33,48,593.00	33,56,00,046.00	42,08,617.00
II. EXPENDITURE								
a) Scientific Expenses of the Centre	D	8,60,30,935.00	13,51,203.07	10,14,69,271.00	18,75,00,206.00	24,96,824.00	22,02,93,637.00	27,89,846.00
b) Governing Body/ SC/IRC Expenses	E	75,79,078.00	65,846.43	49,44,771.00	1,25,23,849.00	1,66,773.00	1,11,34,658.00	1,37,810.00
c) Travelling Expenses	F	18,81,850.00	17,766.00	13,34,147.00	32,15,997.00	42,825.00	34,17,073.00	42,572.00
d) Office Expenses	G	71,32,846.00	1,231.40	92,472.00	72,05,318.00	95,951.00	69,93,678.00	88,277.00
e) Expenses-Non Shareable	H	39,80,700.00	65,765.00	49,38,635.00	89,19,355.00	1,18,774.00	86,09,590.00	1,05,485.00
f) Salaries	I	1,61,84,861.00	-	-	1,61,84,861.00	2,15,524.00	1,40,94,157.00	1,76,195.00
g) Non Core Programme & ExtraMural Activities		-	-	-	-	-	3,91,12,410.00	4,95,641.00
h) Loss on sale of assets		26,393.00	-	-	26,393.00	351.00	6,88,651.00	8,220.00
i) Gratuity Fund		-	-	-	-	-	33,308.00	435.00
j) Depreciation on assets		13,63,620.00	-	-	13,63,620.00	18,156.00	13,50,429.00	18,925.00
k) BRICS Meeting		1,83,089.00	-	-	1,83,089.00	2,438.00	-	-
l) Programme Implementation Charges-Non-core Programmes		3,64,921.00	-	-	3,64,921.00	4,860.00	-	-
m) Operational Expenses- Non-core Programmes		18,21,288.00	-	-	18,21,288.00	24,252.00	-	-
TOTAL		12,65,29,581.00	15,01,811.90	11,27,79,316.00	23,93,08,897.00	31,86,730.00	30,56,60,391.00	38,63,406.00
III. Excess of Income Over Expenditure								
		3,73,55,705.00	(3,37,978.22)	(2,52,00,630.00)	1,21,55,075.00	1,61,863.00	3,09,39,455.00	3,45,211.00
IV. Prior Period Items								
		1,55,008.00	-	-	1,55,008.00	2,064.00	12,11,818.00	14,708.00
V. Transfer for Specific Programme-BRICS Meetings								
		(51,411.00)	-	-	(51,411.00)	(685.00)	-	-
VI. Appropriation of unutilised funds for Targetted/ExtraMural programmes								
		-	-	-	-	-	3,84,88,556.00	(5,74,361.00)
Balance of Surplus Funds		3,74,59,302.00	(3,37,978.22)	(2,52,00,630.00)	1,22,98,672.00	1,63,242.00	(63,37,283.00)	(2,14,442.00)

Accounting policies and notes on accounts

J

As per our report of even date.
 For SSAS AND ASSOCIATES
 Firm Registration No. 08550N

Chartered Accountants

Alpana Saxena
 ALPANA SAXENA
 Partner

Membership No. 095837
 Place : New Delhi
 Date : 30.09.2016



Pranav
 PRANAV SHARMA
 ASSISTANT ACCOUNTS OFFICER

Mathew
 MATHEW JOSEPH
 ACCOUNTS OFFICER

Mukesh Kumar
 DR. MUKESH KUMAR
 DIRECTOR

INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI
RECEIPT AND PAYMENT FOR THE YEAR ENDED ON 31ST MARCH 2016 AND FOR THE YEAR ENDED 31ST MARCH, 2015

	Sch	Amount for the year ended March 31, 2016					Amount for the year ended March 31, 2015		
		(Conversion Factor Rs/Euro=75.0955)					Total Transaction converted in Rs	Total Transaction converted in Euro	
		Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	Total Transaction converted in Rs	Total Transaction converted in Euro			
I. Receipts									
1. Balance Brought Forward									
a) Union Bank of India Ramjan Charpak Account		61,68,689.00	-	-	61,68,689.00	82,055.00	54,86,245.00	66,587.00	
b) Union Bank of India DST INRA Account		25,24,445.00	-	-	25,24,445.00	37,672.00	-	-	
c) Union Bank of India DST INRIA Account		2,91,140.00	-	-	2,91,140.00	4,345.00	-	-	
d) Union Bank of India IFCAM Account		40,39,306.00	-	-	40,39,306.00	60,278.00	56,12,895.00	68,124.00	
e) Union Bank of India-DST ANR Account		7,47,245.00	-	-	7,47,245.00	11,151.00	3,42,706.00	4,160.00	
f) State Bank of Hyderabad Account		2,05,71,041.00	-	-	2,05,71,041.00	3,06,980.00	2,76,96,090.00	3,36,350.00	
g) Union Bank of India		3,76,628.00	-	-	3,76,628.00	5,020.00	3,62,003.00	4,393.00	
h) Axis Bank Account		6,75,735.00	-	-	6,75,735.00	10,084.00	6,75,735.00	8,202.00	
i) State Bank of Hyderabad (Gratuity Fund) Account		22,32,233.00	-	-	22,32,233.00	33,311.00	21,74,984.00	26,398.00	
j) CIC, Paris		-	10,80,426.00	7,24,00,427.00	7,24,00,427.00	10,80,426.00	7,89,93,264.00	9,58,749.00	
Total Opening Balance		3,76,26,462.00	10,80,426.00	7,24,00,427.00	11,00,26,889.00	16,41,922.00	12,13,43,922.00	14,72,763.00	
2. Grant-in-aid- Core									
a) Government of India		13,18,81,192.00	-	-	13,18,81,192.00	17,56,180.00	12,50,00,000.00	15,81,743.00	
b) Government of France		-	15,50,000.00	11,63,98,025.00	11,63,98,025.00	15,50,000.00	12,44,11,460.00	15,50,000.00	
c) BRICS Meetings		2,34,500.00	-	-	2,34,500.00	3,123.00	-	-	
d) Grant from Govt. of France-Group Farming		-	6,177.00	4,63,865.00	4,63,865.00	6,177.00	-	-	
3. Grant-in-aid- Non Core & Extra Mural Activities									
a) Government of India		3,15,52,943.00	-	-	3,15,52,943.00	4,20,171.00	2,93,28,486.00	3,71,641.00	
b) Government of France		-	3,25,343.32	2,44,31,819.00	2,44,31,819.00	3,25,343.00	3,22,85,700.00	3,94,166.00	
4. Interest from Bank Accounts									
a) State Bank of Hyderabad (Net of TDS)		15,35,383.00	-	-	15,35,383.00	20,446.00	9,27,840.00	11,720.00	
b) UBI-Bank		15,216.00	-	-	15,216.00	203.00	14,623.00	191.00	
c) State Bank of Hyderabad-Gratuity account		-	-	-	-	-	90,556.00	1,182.00	
d) UBI Bank-Non Core Programmes		6,05,411.00	-	-	6,05,411.00	8,062.00	5,52,984.00	7,218.00	
e) Axis bank interest		56,069.00	-	-	56,069.00	747.00	-	-	
5. Misc Income		50,769.00	-	-	50,769.00	676.00	57,598.00	-	
6. Refund of Security Deposit-Director Residence		-	-	-	-	-	1,58,049.00	2,034.00	
7. Programme Implementation and Overhead		16,12,339.00	7,656.68	5,74,982.00	21,87,321.00	29,127.00	-	-	
8. Repatriation of Funds-Core Fund		2,85,28,017.00	(3,92,343.32)	(2,94,63,218.00)	-	-	-	-	
9. Repatriation of Funds-Programme Implementation & Overheads Charges-Non-core Programmes		5,74,982.00	(7,656.68)	(5,74,982.00)	-	-	-	-	
10. Gain/(loss) on repatriation		-	-	-	(9,34,201.00)	(12,440.00)	-	-	
11. Advance Recovered during the Year		3,017.00	-	-	3,017.00	40.00	-	-	
12. Exchange Fluctuation		-	-	-	-	-	-	-	
a) In conversion of Opening Balance of CIC, Paris		-	-	87,34,704.00	87,34,704.00	-	-	-	
TOTAL		19,66,50,838.00	14,89,177.00	12,05,65,195.00	31,72,16,033.00	41,07,855.00	31,28,27,298.00	39,19,895.00	
TOTAL RECEIPTS		23,42,77,300.00	25,69,603.00	19,29,65,622.00	42,72,42,922.00	57,49,777.00	43,41,71,220.00	53,92,658.00	



Danu

Mathu

Mukul Kumar

INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI
RECEIPT AND PAYMENT FOR THE YEAR ENDED ON 31ST MARCH 2016 AND FOR THE YEAR ENDED 31ST MARCH, 2015

	Sch	Amount as at 31st March, 2016					Amount as at 31st March, 2015	
		(Conversion Factor Rs/Euro=75.0955)					Total Transaction converted in Rs	Total Transaction converted in Euro
		Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	Total Transaction converted in Rs	Total Transaction converted in Euro		
II. PAYMENTS								
a) Scientific Expenses of the Centre	RP1	8,60,30,935.00	12,63,551.59	9,48,87,040.00	15,09,17,975.00	24,09,172.00	21,92,52,817.00	27,99,763.00
b) Governing Body/ SC/IRC Expenses		75,79,078.00	65,846.43	49,44,771.00	1,25,23,849.00	1,66,772.00	1,05,34,648.00	1,28,856.00
c) Travelling Expenses		18,81,850.00	17,766.00	13,34,147.00	32,15,997.00	42,825.00	34,17,073.00	42,572.00
d) Office Expenses	RP2	62,89,550.00	1,231.40	92,472.00	63,82,022.00	84,985.00	54,69,667.00	66,752.00
e) Expenses-Non Shareable		39,80,700.00	65,765.00	49,38,655.00	89,19,355.00	-1,18,773.00	86,09,590.00	1,05,485.00
f) Salaries		1,61,84,861.00	-	-	1,61,84,861.00	2,15,524.00	1,40,94,157.00	1,76,195.00
g) Non Core programmes & Extra Mural Activities		2,55,39,286.00	91,404.46	68,64,064.00	3,24,08,350.00	4,31,495.00	3,91,12,410.00	4,95,641.00
h) Purchase of Assets net of sales		81,795.00	-	-	81,795.00	1,089.00	47,00,073.00	76,953.00
i) Gratuity Fund		-	-	-	-	-	33,308.00	435.00
j) BRICS Meetings		1,83,089.00	-	-	1,83,089.00	2,438.00	-	-
k) Programme Implementation Charges-Non-core Programmes		3,64,921.00	-	-	3,64,921.00	4,859.00	-	-
l) Operational Expenses-Non-core Programmes		18,21,288.00	-	-	18,21,288.00	24,253.00	-	-
m) Tour Advances	RP3	19,61,554.00	-	-	19,61,554.00	26,121.00	-	-
n) Other Payments		-	-	-	-	-	1,11,547.00	1,634.00
o) Seminar Releases	RP4	18,21,065.00	-	-	18,21,065.00	24,250.00	-	-
q) Payment of Previous Year Liability		9,60,272.00	-	-	9,60,272.00	12,787.00	-	-
r) Exchange Fluctuation in conversion of Indian Bank Accounts		-	-	-	-	60,448.00	1,88,09,108.00	(1,41,548.00)
r) Rounding off		-	-	(2.00)	(2.00)	4.00	-	(2.00)
TOTAL EXPENDITURE		15,46,80,244.00	15,05,564.88	11,30,61,147.00	26,77,41,391.00	36,25,795.00	32,41,44,398.00	37,50,736.00
III. Cash & Cash Equivalent								
Balance carried forward								
a) Union Bank of India Raman Charpak Account		80,41,970.00	-	-	80,41,970.00	1,07,090.00	61,68,686.00	92,055.00
b) Union Bank of India DST INRIA Account		27,15,695.00	-	-	27,15,695.00	36,163.00	25,24,445.00	37,672.00
c) Union Bank of India DST INRA Account		7,10,582.00	-	-	7,10,582.00	9,462.00	-2,91,140.00	4,345.00
d) Union Bank of India IFCAM Account		65,31,507.00	-	-	65,31,507.00	86,976.00	40,39,306.00	60,278.00
e) Union Bank of India-DST ANR Account		21,55,217.00	-	-	21,55,217.00	28,700.00	7,47,245.00	11,151.00
f) State Bank of Hyderabad Account		5,60,86,204.00	-	-	5,60,86,204.00	7,46,865.00	2,05,71,041.00	3,06,980.00
g) Union Bank of India-CIFIRA Account		3,91,844.00	-	-	3,91,844.00	5,218.00	3,76,628.00	5,620.00
h) Axis Bank Account		7,31,804.00	-	-	7,31,804.00	9,745.00	6,75,735.00	10,084.00
i) State Bank of Hyderabad (Gratuity Fund) Account		22,32,233.00	-	-	22,32,233.00	29,725.00	22,32,233.00	33,311.00
j) CIC Paris		-	10,64,038.12	7,99,04,475.00	7,99,04,475.00	10,64,038.00	7,24,00,360.00	10,80,426.00
TOTAL CLOSING BANK BALANCE		7,95,97,056.00	10,64,038.12	7,99,04,475.00	15,95,01,531.00	21,23,982.00	11,00,26,822.00	16,41,922.00
TOTAL		23,42,77,300.00	25,69,603.00	19,29,65,622.00	42,72,42,922.00	57,49,777.00	43,41,71,220.00	53,92,658.00

Accounting policies and notes on accounts

As per our report of even date
 For SSAS AND ASSOCIATES
 Firm Registration No. 00850N

Chartered Accountants

Alpan Saxena
 ALPAN SAXENA

Partner
 Membership No. 095837
 Place - New Delhi
 Date - 30.09.2016



Pranav Sharma
 PRANAV SHARMA
 ASSISTANT ACCOUNTS OFFICER

Mathew Joseph
 MATHEW JOSEPH
 ACCOUNTS OFFICER

Mukesh Kumar
 DR. MUKESH KUMAR
 DIRECTOR

INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI

SCHEDULES FORMING PART OF THE BALANCE SHEET FOR THE YEAR ENDED ON 31ST MARCH 2016 AND FOR THE YEAR ENDED 31ST MARCH, 2015

	Amount as on 31st March 2016 (Conversion Factor Rs/Euro=75.0955)					Amount as on 31st March 2015	
	Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	Total Transaction converted in Rs	Total Transaction converted in Euro	Total Transaction in Rs	Total Transaction in Euro
	Schedule 'A'						
Core Programme Reserves							
Balance Brought Forward	3,56,43,231.00	7,17,631.00	6,88,98,326.00	10,25,41,557.00	13,65,482.00	10,86,89,300.00	13,19,173.00
Adjustment During the year	7,12,969.00	1,27,975.16	96,10,359.00	1,03,23,328.00	1,37,469.00	-	-
Adjustment of Opening Balance	-	-	(1,88,09,155.00)	(1,88,09,155.00)	(2,50,470.00)	-	-
Non Core Programme Adjustment	-	-	-	-	-	41,277.00	3,426.00
Transfer from Non Core Fund	-	-	-	-	-	1,48,263.00	-
Surplus/(Deficit) from Income & Expenditure account	3,74,59,302.00	(3,37,978.22)	(2,52,00,630.00)	1,22,58,672.00	1,63,242.00	(63,37,283.00)	(2,14,442.00)
Balance Carried forward	7,38,15,502.00	5,07,627.94	3,24,98,900.00	10,63,14,402.00	14,15,723.00	10,25,41,557.00	11,08,157.00
Schedule 'B'							
Non Core Programme & Extra Mural Reserves B1							
Balance Brought Forward	1,37,83,340.00	3,68,674.00	2,47,06,216.00	3,84,88,556.00	5,12,528.00	2,16,41,420.00	3,11,191.00
Core Programme Adjustment	-	-	-	-	-	-	-
Transfer from Non Core Fund	-	-	-	-	-	-	-
Add: Funds received during the year	3,31,65,282.00	3,33,000.00	2,50,06,802.00	5,81,72,084.00	7,74,641.00	6,16,14,186.00	7,65,807.00
Interest Earned during the Year	6,05,411.00	-	-	6,05,411.00	8,062.00	5,52,984.00	7,218.00
Total Available Funds	4,75,54,033.00	7,01,674.00	4,97,12,018.00	9,72,66,051.00	12,95,231.00	8,38,08,590.00	10,84,216.00
less: Utilised as per programme objectives	2,55,39,286.00	91,404.48	68,64,064.00	3,24,03,350.00	4,31,495.00	3,91,12,410.00	4,95,641.00
Balance Unspent Funds	2,20,14,747.00	6,10,269.54	4,28,47,954.00	6,48,62,701.00	8,63,736.00	3,84,88,556.00	5,74,361.00
Less: Transfer for operational expenses	16,12,339.00	7,656.68	5,74,982.00	21,87,321.00	29,127.00	-	-
Amount carried forward for program activities	2,04,02,408.00	6,02,612.86	4,22,72,972.00	6,26,75,380.00	8,34,609.00	3,84,88,556.00	5,74,361.00

Danar

Mathu

Murlikumar



INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI
SCHEDULES FORMING PART OF THE BALANCE SHEET FOR THE YEAR ENDED ON 31ST MARCH 2016 AND FOR THE YEAR ENDED 31ST MARCH, 2015

Schedule B1 : Non- Core Programmes and Extra Mural Activities

	Amount as on 31st March, 2016					Amount as on 31st March, 2015	
	(Conversion Factor Rs./Euro=75.0955)						
	Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	Total Transaction converted in Rs	Total Transaction converted in Euro	Total Transaction converted in Rs	Total Transaction converted in Euro
IFCAM Projects							
Opening Balance	12,65,149.00	20,736.00	13,89,540.00	26,34,889.00	39,616.00	26,70,957.00	35,858.00
Add: Grant Received during The year	1,14,90,000.00	42,000.00	81,54,011.00	1,46,44,011.00	1,95,005.00	84,59,919.00	1,26,247.00
Add: Bank Interest	1,42,943.00	-	-	1,42,343.00	1,895.00	2,63,072.00	3,926.00
Total Available Funds	1,28,97,492.00	62,736.00	45,43,551.00	1,74,41,043.00	2,36,516.00	1,13,93,948.00	1,70,031.00
Less: Expenditure Incurred	85,00,679.00	-	-	85,00,679.00	1,13,198.00	87,39,259.00	1,30,415.00
Unspent Balance	43,96,813.00	62,736.00	45,43,551.00	89,40,364.00	1,23,318.00	26,54,689.00	39,616.00
Less: Transfer of Programme Implementation & OverheadCharges	1,50,000.00	1,500.00	1,12,643.00	2,62,643.00	3,497.00	-	-
Closing Balance carried forward	42,46,813.00	61,236.00	44,30,908.00	86,77,721.00	1,19,821.00	26,54,689.00	39,616.00
DST-ANR Projects							
Opening Balance	4,09,055.00	(948.00)	(63,526.00)	3,45,529.00	5,156.00	48,213.00	719.00
Add: Grant Received during The year	50,00,000.00	-	-	50,00,000.00	66,582.00	50,52,180.00	75,393.00
Add: Bank Interest	52,973.00	-	-	52,973.00	705.00	80,484.00	1,201.00
Total Available Funds	54,62,028.00	(948.00)	(63,526.00)	53,98,502.00	72,443.00	51,80,877.00	77,314.00
Less: Expenditure Incurred	36,24,070.00	-	-	36,24,070.00	48,258.00	48,35,348.00	72,158.00
Unspent Balance	18,37,958.00	(948.00)	(63,526.00)	17,74,432.00	24,184.00	3,45,529.00	5,156.00
Less: Transfer of Programme Implementation & OverheadCharges	9,00,000.00	-	-	5,00,000.00	6,658.00	-	-
Closing Balance carried forward	13,37,958.00	(948.00)	(63,526.00)	12,74,432.00	17,526.00	3,45,529.00	5,156.00
DST-INRA Projects							
Opening Balance	22,25,921.00	50,000.00	33,50,350.00	55,76,471.00	89,217.00	(10,15,523.00)	(15,155.00)
Add: Grant Received during The year	-	-	-	-	-	72,14,150.00	1,07,656.00
Add: Bank Interest	1,00,938.00	-	-	1,00,938.00	1,344.00	59,116.00	885.00
Total Available Funds	23,26,859.00	50,000.00	33,50,350.00	56,77,409.00	90,561.00	62,57,943.00	83,387.00
Less: Expenditure Incurred	23,62,774.00	-	-	23,62,774.00	31,464.00	6,81,472.00	10,170.00
Unspent Balance	(35,915.00)	50,000.00	33,50,350.00	33,14,635.00	59,097.00	55,76,471.00	83,217.00
Less: Transfer of Programme Implementation & OverheadCharges	-	-	-	-	-	-	-
Closing Balance carried forward	(35,915.00)	50,000.00	33,50,350.00	33,14,635.00	59,097.00	55,76,471.00	83,217.00
DST-INRIA Projects							
Opening Balance	69,802.00	(554.00)	(37,124.00)	32,678.00	786.00	(3,88,012.00)	(2,806.00)
Add: Grant Received during The year	68,30,072.00	-	-	68,30,072.00	90,952.00	67,78,906.00	1,01,161.00
Add: Bank Interest	28,862.00	-	-	28,862.00	384.00	12,515.00	187.00
Total Available Funds	69,48,736.00	(554.00)	(37,124.00)	69,11,612.00	92,122.00	66,03,409.00	98,542.00
Less: Expenditure Incurred	43,61,687.00	-	-	43,61,687.00	58,082.00	65,50,731.00	97,756.00
Unspent Balance	25,87,049.00	(554.00)	(37,124.00)	25,49,925.00	34,040.00	52,678.00	786.00
Less: Transfer of Programme Implementation & OverheadCharges	5,00,000.00	-	-	5,00,000.00	6,658.00	-	-
Closing Balance carried forward	20,87,049.00	(554.00)	(37,124.00)	20,49,925.00	27,382.00	52,678.00	786.00
Raman Charpak Fellowship							
Opening Balance	54,11,023.00	32,979.00	22,09,956.00	76,20,978.00	1,13,727.00	23,04,460.00	34,389.00
Add: Grant Received during The year	50,00,000.00	1,41,000.00	1,05,88,466.00	1,55,88,466.00	2,07,582.00	1,40,51,130.00	2,09,684.00
Add: Bank Interest	2,80,295.00	-	-	2,80,295.00	3,733.00	1,37,597.00	2,053.00
Total Available Funds	1,06,91,317.00	1,73,979.00	1,27,98,422.00	1,34,89,739.00	3,25,042.00	1,64,93,187.00	2,46,127.00
Less: Expenditure Incurred	32,41,874.00	61,956.58	46,51,660.00	78,94,534.00	1,05,127.00	88,72,209.00	1,32,399.00
Unspent Balance	74,49,443.00	1,12,022.42	81,46,762.00	1,55,95,205.00	2,19,915.00	76,20,978.00	1,13,727.00
Less: Transfer of Programme Implementation & OverheadCharges	4,62,339.00	6,156.68	4,62,339.00	5,24,678.00	12,313.00	-	-
Closing Balance carried forward	69,87,104.00	1,05,865.74	76,83,423.00	1,46,70,527.00	2,07,602.00	76,20,978.00	1,13,727.00
BIRAC French Embassy Projects							
Opening Balance	17,46,374.00	75,520.00	51,27,682.00	68,74,056.00	1,02,581.00	-	-
Add: Grant Received during The year	-	1,20,000.00	90,11,460.00	90,11,460.00	1,20,000.00	43,97,400.00	65,622.00
Total Available Funds	17,46,374.00	1,96,520.00	1,41,39,142.00	1,58,85,516.00	2,22,581.00	43,97,400.00	65,622.00
Less: Expenditure Incurred	19,50,000.00	34,000.00	18,02,292.00	37,52,292.00	49,967.00	40,50,310.00	60,442.00
Add: Transfer from Challenges in Health Programme	-	-	-	-	-	65,26,966.00	97,401.00
Closing Balance carried forward	(2,03,626.00)	1,72,520.00	1,23,36,850.00	1,21,33,224.00	1,72,614.00	68,74,056.00	1,02,581.00
Economic Diplomacy R & D Programme							
Opening Balance	-	14,882.00	9,97,258.00	9,97,258.00	14,882.00	22,09,279.00	32,969.00
Add: Grant Received during The year	-	-	-	-	-	-	-
Total Available Funds	-	14,882.00	9,97,258.00	9,97,258.00	14,882.00	22,09,279.00	32,969.00
Less: Expenditure Incurred	1,09,113.00	1,010.34	75,872.00	1,84,985.00	2,463.00	12,12,021.00	18,087.00
Closing Balance carried forward	(1,09,113.00)	13,871.66	9,21,386.00	8,12,273.00	12,419.00	9,97,258.00	14,882.00



Pranav Mathi Muleshwar

Project with IIT Rajasthan							
Opening Balance	-	39,238.00	26,29,378.00	26,29,378.00	39,238.00	26,75,948.00	39,933.00
Add: Grant Received during The year	-	-	-	-	-	-	-
Total Available Funds	-	39,238.00	26,29,378.00	26,29,378.00	39,238.00	26,75,948.00	39,933.00
Less: Expenditure Incurred	5,94,163.00	3,000.00	2,25,287.00	8,19,450.00	10,912.00	46,570.00	695.00
Closing Balance carried forward	(5,94,163.00)	36,238.00	24,04,091.00	18,09,928.00	28,326.00	26,29,378.00	39,238.00
India-France Technology Summit							
Opening Balance	18,93,314.00	1,20,007.00	80,41,789.00	99,35,103.00	1,48,261.00	40,94,703.00	61,105.00
Add: Grant Received during The year	-	-	-	-	-	1,29,32,090.00	1,92,985.00
Total Available Funds	18,93,314.00	1,20,007.00	80,41,789.00	99,35,103.00	1,48,261.00	1,70,26,793.00	2,54,090.00
Less: Expenditure Incurred	7,58,860.00	-	-	7,58,860.00	10,105.00	70,91,690.00	1,05,829.00
Closing Balance carried forward	11,34,454.00	1,20,007.00	80,41,789.00	91,76,243.00	1,38,156.00	99,35,103.00	1,48,261.00
Water Network							
Opening Balance	-	16,503.00	11,05,883.00	11,05,883.00	16,503.00	11,05,883.00	16,503.00
Add: Grant Received during The year	-	-	-	-	-	-	-
Total Available Funds	-	16,503.00	11,05,883.00	11,05,883.00	16,503.00	11,05,883.00	16,503.00
Less: Expenditure Incurred	36,066.00	1,437.54	1,07,953.00	1,44,019.00	1,918.00	-	-
Closing Balance carried forward	(36,066.00)	15,065.46	9,97,930.00	9,61,864.00	14,585.00	11,05,883.00	16,503.00
India Science & Innovation house							
Opening Balance	-	(582.00)	(39,000.00)	(39,000.00)	(582.00)	10,19,609.00	15,216.00
Add: Grant Received during The year	-	-	-	-	-	-	-
Total Available Funds	-	(582.00)	(39,000.00)	(39,000.00)	(582.00)	10,19,609.00	15,216.00
Less: Expenditure Incurred	-	-	-	-	-	10,58,609.00	15,798.00
Closing Balance carried forward	-	(582.00)	(39,000.00)	(39,000.00)	(582.00)	(39,000.00)	(582.00)
French Season in India							
Opening Balance	7,42,703.00	(107.00)	(7,170.00)	7,35,533.00	10,976.00	7,35,533.00	10,976.00
Add: Grant Received during The year	-	-	-	-	-	-	-
Total Available Funds	7,42,703.00	(107.00)	(7,170.00)	7,35,533.00	10,976.00	7,35,533.00	10,976.00
Less: Expenditure Incurred	-	-	-	-	-	-	-
Closing Balance carried forward	7,42,703.00	(107.00)	(7,170.00)	7,35,533.00	10,976.00	7,35,533.00	10,976.00
IFWN							
Opening Balance	-	-	-	-	-	79,465.00	1,186.00
Add: Grant Received during The year	48,45,210.00	30,000.00	22,52,865.00	70,98,075.00	94,521.00	27,28,411.00	40,716.00
Total Available Funds	48,45,210.00	30,000.00	22,52,865.00	70,98,075.00	94,521.00	28,07,876.00	41,902.00
Less: Expenditure Incurred	-	-	-	-	-	28,07,876.00	41,902.00
Closing Balance carried forward	48,45,210.00	30,000.00	22,52,865.00	70,98,075.00	94,521.00	-	-

Dona

Mathy

Mulshikumar



INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI
SCHEDULES FORMING PART OF THE BALANCE SHEET FOR THE YEAR ENDED ON 31ST MARCH 2016

Schedule 'C' Fixed Assets

S.No	Particulars	Rate	GROSS BLOCK				DEPRECIATION				NET BLOCK	
			Opening Balance	Additions during the year upto 30.09.2015	Sold during year	Closing balance after 30.09.2015	Upto 31.03.2015	Depreciation for the year	Adjustment	Total	Balance as on 31-03-2016	Balance as on 31-03-2015
1	CAR	0.15	6,04,763.00	-	-	6,04,763.00	2,94,045.00	46,608.00	3,40,653.00	2,64,110.00	3,10,718.00	
2	FURNITURE & FIXTURE	0.10	13,34,141.00	17,200.00	2,58,359.00	10,92,982.00	35,945.00	1,10,254.00	92,095.00	10,00,887.00	12,98,196.00	
3	OFFICE EQUIPMENT	0.15	40,82,634.00	24,950.00	65,050.00	40,95,635.00	15,68,552.00	3,76,334.00	8,363.00	21,59,112.00	25,14,082.00	
4	COMPUTER	0.60	20,02,846.00	1,22,950.00	1,80,700.00	20,16,286.00	13,89,860.00	4,52,984.00	1,64,143.00	16,78,701.00	6,12,986.00	
5	LAND & BUILDING	0.10	1,47,71,284.00	-	-	1,47,71,284.00	1,26,51,777.00	2,11,951.00	1,28,63,728.00	19,07,556.00	21,19,507.00	
6	PHOTOCOPIER	0.15	4,50,097.00	-	-	4,50,097.00	3,52,008.00	14,713.00	3,66,721.00	83,376.00	98,089.00	
7	TELEPHONE SYSTEM	0.15	16,42,448.00	43,510.00	-	16,85,958.00	6,80,784.00	1,50,776.00	8,31,560.00	8,54,398.00	9,61,664.00	
			2,48,88,213.00	1,91,410.00	5,04,109.00	2,47,17,005.00	1,69,72,971.00	13,63,620.00	2,26,610.00	1,81,09,981.00	79,15,242.00	
	Previous Year		2,54,36,522.00	47,91,594.00	64,13,786.00	2,48,88,213.00	2,12,39,709.00	13,50,429.00	56,17,167.00	1,69,72,971.00		

Raman *Shetty*

Mulchandani



INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI

SCHEDULES FORMING PART OF THE INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH 2016 AND FOR THE YEAR ENDED 31ST MARCH, 2015

	Amount for the year ended March 31, 2016 (Conversion Factor 1 Euro = Rs. 75.0955)					Amount for the year ended March 31, 2015	
	Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	Total Transaction converted in Rs	Total Transaction converted in Euro	Transaction in Rs	Transaction in Euro
	Schedule 'D'						
Scientific Expenses of the Centre							
Research Projects	6,08,00,804.00	11,65,503.52	8,75,24,070.00	14,83,24,874.00	19,75,150.00	17,84,17,519.00	22,57,243.00
Industrial Research Projects	58,69,318.00	82,804.73	62,18,263.00	1,20,87,581.00	1,60,963.00	1,33,05,865.00	1,69,715.00
Seminars & Workshops	92,25,115.00	65,695.06	49,33,403.00	1,41,58,518.00	1,88,540.00	1,71,83,864.00	2,19,228.00
PPP Programmes (SGRI Projects)	43,28,043.00	-	-	43,28,043.00	57,634.00	43,02,938.00	55,976.00
Professional & Other Scientific Expenses	-	-	-	-	-	12,68,694.00	15,921.00
Evaluation of R & D of CEFIPRA Projects	83,830.00	-	-	83,830.00	1,116.00	-	-
Expenses on Outreach	2,62,402.00	145.60	10,934.00	2,73,336.00	3,640.00	8,96,744.00	11,449.00
Scientific Publication	30,93,171.00	-	-	30,93,171.00	41,190.00	12,93,786.00	16,295.00
Expenses on Patents	-	-	-	-	-	45,813.00	590.00
Expenses in Connection with ESDNN	7,42,669.00	19,200.00	14,41,834.00	21,84,503.00	29,090.00	27,53,648.00	33,466.00
Cefipra Lecture Series	-	17,854.16	13,40,767.00	13,40,767.00	17,854.00	7,49,093.00	9,770.00
Region to Region	21,530.00	-	-	21,530.00	287.00	15,673.00	193.00
Synchrotron meetings	15,97,731.00	-	-	15,97,731.00	21,276.00	-	-
Airbus Project	6,322.00	-	-	6,322.00	84.00	-	-
	8,60,30,935.00	13,51,203.07	10,14,69,271.00	18,75,00,206.00	24,96,824.00	22,02,33,637.00	27,89,846.00
Schedule 'E'							
Governing Body/ SC/IRC Meeting Expenses							
Governing Body	25,18,962.00	9,715.25	7,29,572.00	32,48,534.00	43,259.00	10,08,283.00	12,244.00
Scientific Council	35,59,517.00	43,974.99	33,02,324.00	68,61,841.00	91,375.00	80,32,944.00	99,841.00
Industrial Research Committee	15,00,599.00	12,156.19	9,12,875.00	24,13,474.00	32,139.00	20,93,431.00	25,725.00
	75,79,078.00	65,846.43	49,44,771.00	1,25,23,849.00	1,66,773.00	1,11,34,658.00	1,37,810.00
Schedule 'F'							
Travelling Expenses							
Domestic	3,69,190.00	-	-	3,69,190.00	4,916.00	8,62,239.00	11,029.00
International	15,12,660.00	17,766.00	13,34,147.00	28,46,807.00	37,909.00	25,54,834.00	31,543.00
	18,81,850.00	17,766.00	13,34,147.00	32,15,997.00	42,825.00	34,17,073.00	42,572.00
Schedule 'G'							
Office Expenses - Shareable							
Communication Expenses	9,91,775.00	-	-	9,91,775.00	13,207.00	15,10,690.00	19,026.00
Conveyance Expenses	1,44,238.00	-	-	1,44,238.00	1,921.00	4,86,916.00	6,108.00
Entertainment Expenses	21,831.00	96.40	7,239.00	29,070.00	387.00	72,427.00	914.00
Repair & Maintenance	1,24,952.00	-	-	1,24,952.00	1,664.00	1,73,790.00	2,089.00
Electricity Expenses	2,06,405.00	-	-	2,06,405.00	2,749.00	2,84,125.00	3,646.00
Security Charges	2,78,208.00	-	-	2,78,208.00	3,705.00	2,81,360.00	3,545.00
Rent	-	-	-	-	-	4,68,600.00	5,740.00
IT Admin Charges	-	-	-	-	-	1,56,250.00	2,040.00
Other Office Expenses	1,38,169.00	-	-	1,38,169.00	1,840.00	2,21,953.00	2,776.00
Bank Charges	23,400.00	-	-	23,400.00	312.00	1,91,258.00	2,495.00
Electronic Project Proposal Management	13,70,024.00	-	-	13,70,024.00	18,244.00	7,14,430.00	9,327.00
Books & Periodicals	32,983.00	-	-	32,983.00	439.00	1,83,953.00	2,247.00
Canteen Expenses	1,08,827.00	-	-	1,08,827.00	1,449.00	98,102.00	1,239.00
Festival Expenses	80,166.00	-	-	80,166.00	1,068.00	49,362.00	636.00
Office Insurance	4,010.00	-	-	4,010.00	53.00	6,402.00	83.00
Livries	21,821.00	-	-	21,821.00	291.00	-	-
Management Service	2,63,930.00	-	-	2,63,930.00	3,515.00	21,690.00	283.00
Printing and Stationery	6,77,490.00	-	-	6,77,490.00	9,022.00	10,21,720.00	12,834.00
Staff Car Expenses	2,65,546.00	-	-	2,65,546.00	3,536.00	-	-
Professional & Legal Expenses	1,95,257.00	-	-	1,95,257.00	2,600.00	5,60,636.00	7,240.00
Recruitment Expenses	11,88,018.00	1,135.00	85,233.00	12,73,251.00	16,955.00	87,117.00	1,137.00
Advertisement Expenses	13,28,729.00	-	-	13,28,729.00	17,694.00	4,00,897.00	4,872.00
Total Office expenses	74,65,779.00	1,231.40	92,472.00	75,58,251.00	1,00,651.00	69,91,678.00	88,277.00
Less: Office Expenses for Non Core	(3,52,933.00)	-	-	(3,52,933.00)	(4,700.00)	-	-
	71,12,846.00	1,231.40	92,472.00	72,05,318.00	95,951.00	69,91,678.00	88,277.00



Dina Mathu

Schedule 'H'							
Expenses - Non-Shareable							
Maintenance Charges to IHC	10,06,543.00	-	-	10,06,543.00	13,404.00	9,54,191.00	11,876.00
Maintenance - Office Premises	3,33,330.00	-	-	3,33,330.00	4,439.00	2,92,424.00	3,743.00
Municipal Tax	2,06,160.00	-	-	2,06,160.00	2,745.00	-	-
Renovation Expenses	-	-	-	-	-	70,59,638.00	85,984.00
Computer Software	16,203.00	-	-	16,203.00	216.00	3,03,337.00	3,882.00
Group Farming Project	11,68,464.00	60,001.00	45,05,805.00	56,74,269.00	75,561.00	-	-
Network Projects	12,50,000.00	5,764.00	4,32,850.00	16,82,850.00	22,409.00	-	-
	39,80,700.00	65,765.00	49,38,655.00	89,19,355.00	1,18,774.00	86,09,590.00	1,05,485.00
Schedule 'I'							
Salaries	1,76,53,216.00	-	-	1,76,53,216.00	2,35,077.00	1,40,94,157.00	1,76,195.00
Less: Salaries for Non Core Programmes	(14,68,355.00)	-	-	(14,68,355.00)	(19,553.00)	-	-
	1,61,84,861.00	-	-	1,61,84,861.00	2,15,524.00	1,40,94,157.00	1,76,195.00



Pranav

Mathu

Mukesh Kumar

INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, NEW DELHI

SCHEDULES FORMING PART OF THE RECEIPTS & PAYMENTS ACCOUNT FOR THE YEAR ENDED ON 31ST MARCH 2016 AND FOR THE YEAR ENDED 31ST MARCH, 2015

	Amount as on March 31, 2016 (Conversion Factor 1 Euro = Rs. 75.0955)					Amount as on March 31, 2015	
	Transaction in Rs	Transaction in Euro	Euro Transaction converted in Rs	Total Transaction converted in Rs	Total Transaction converted in Euro	Transaction in Rs	Transaction in Euro
	Schedule 'RP1'						
Scientific Expenses of the Centre							
Research Projects	6,08,00,804.00	11,65,503.52	8,75,24,070.00	14,83,24,874.00	19,75,150.00	17,84,17,519.00	22,57,243.00
Industrial Research Projects	58,69,318.00	82,804.73	62,18,263.00	1,20,87,581.00	1,60,863.00	1,33,05,865.00	1,69,715.00
Seminars & Workshops	92,25,115.00	65,695.06	49,33,403.00	1,41,58,518.00	1,88,540.00	1,71,83,864.00	2,19,228.00
PPP Programmes (SGRI Projects)	43,28,043.00	-	-	43,28,043.00	57,634.00	49,02,988.00	55,976.00
Professional & Other Scientific Expenses	-	-	-	-	-	12,68,694.00	15,921.00
Evaluation of R & D of CEFIPRA Projects	83,830.00	-	-	83,830.00	1,116.00	-	-
Expenses on Outreach	2,62,402.00	145.60	10,934.00	2,73,336.00	3,640.00	8,96,744.00	11,449.00
Scientific Publication	30,93,171.00	-	-	30,93,171.00	41,190.00	12,93,786.00	16,295.00
Expenses on Patents	-	-	-	-	-	45,813.00	590.00
Expenses in Connection with ESONN Programme	7,42,669.00	19,200.00	14,41,834.00	21,84,503.00	29,090.00	27,53,648.00	33,466.00
CeFlora Lecture Series	-	17,854.16	13,40,767.00	13,40,767.00	17,854.00	7,49,093.00	9,770.00
Region to Region	21,530.00	-	-	21,530.00	287.00	15,673.00	193.00
Synchrotron meetings	15,97,731.00	-	-	15,97,731.00	21,276.00	-	-
Airbus Project	6,322.00	-	-	6,322.00	84.00	-	-
8,60,30,935.00	13,51,203.07	10,14,69,271.00	18,75,00,206.00	24,96,824.00	22,02,33,637.00	27,89,846.00	
Adjustment during the year							
Campus France Adjustment	-	(77,952.48)	(58,53,880.00)	(58,53,880.00)	(77,952.00)	-	-
Previous year Adjustment-Bosolo	-	(9,699.00)	(7,28,351.00)	(7,28,351.00)	(9,699.00)	-	-
Hotel Plaza France	-	-	-	-	-	-	9,917.00
Adjustment of Liability and Advances	-	-	-	-	-	-	-
Scientific Expenses Actually Paid during the year	8,60,30,935.00	12,63,551.59	9,48,87,040.00	18,09,17,975.00	24,09,173.00	22,02,33,637.00	27,99,763.00
Schedule 'RP2'							
Office Expenses - Shareable							
Communication Expenses	9,91,775.00	-	-	9,91,775.00	13,207.00	15,10,690.00	19,026.00
Conveyance Expenses	1,44,238.00	-	-	1,44,238.00	1,921.00	4,86,916.00	6,108.00
Entertainment Expenses	21,831.00	96.40	7,239.00	26,070.00	387.00	72,427.00	914.00
Books & periodicals	-	-	-	-	-	1,83,953.00	2,247.00
Repair & Maintenance	1,24,952.00	-	-	1,24,952.00	1,664.00	1,73,790.00	9,280.00
Electricity Expenses	2,06,405.00	-	-	2,06,405.00	2,749.00	2,84,128.00	-
Security Charges	2,78,208.00	-	-	2,78,208.00	3,705.00	2,81,360.00	-
Rent	-	-	-	-	-	4,68,600.00	5,740.00
IT Admin Charges	-	-	-	-	-	1,56,250.00	2,040.00
Other Office Expenses	1,38,169.00	-	-	1,38,169.00	1,840.00	2,21,953.00	5,271.00
Bank Charges	23,400.00	-	-	23,400.00	312.00	1,91,258.00	-
Electronic Project Proposal Management System	13,70,024.00	-	-	13,70,024.00	18,244.00	7,14,430.00	9,327.00
Books & Periodicals	32,983.00	-	-	32,983.00	439.00	-	-
Canteen Expenses	1,08,827.00	-	-	1,08,827.00	1,449.00	98,102.00	1,239.00
Festival Expenses	80,166.00	-	-	80,166.00	1,068.00	49,362.00	636.00
Office Insurance	4,010.00	-	-	4,010.00	53.00	6,402.00	83.00
Livines	21,821.00	-	-	21,821.00	291.00	-	-
Management Service	2,63,930.00	-	-	2,63,930.00	3,515.00	21,690.00	283.00
Printing and Stationery	6,77,490.00	-	-	6,77,490.00	9,022.00	10,21,720.00	12,834.00
Staff Car Expenses	2,65,546.00	-	-	2,65,546.00	3,536.00	-	-
Professional & legal Expenses	1,95,257.00	-	-	1,95,257.00	2,600.00	5,60,636.00	7,240.00
Recruitment Expenses	11,88,018.00	1,135.00	85,293.00	12,73,251.00	16,955.00	87,117.00	1,137.00
Advertisement Expenses	13,28,729.00	-	-	13,28,729.00	17,694.00	4,00,897.00	4,872.00
Total Office expense	74,65,779.00	1,231.40	92,472.00	75,58,251.00	1,00,651.00	69,91,681.00	88,277.00
Office Expenses for Non Core Programmes	(3,52,933.00)	-	-	(3,52,933.00)	(4,700.00)	-	-
	71,12,846.00	1,231.40	92,472.00	72,05,318.00	95,951.00	69,91,681.00	88,277.00
Less: Expenses Payable	8,23,296.00	-	-	8,23,296.00	10,953.00	-	21,525.00
Expenses Paid during the Year	62,89,550.00	1,231.40	92,472.00	63,82,022.00	84,988.00	69,91,681.00	66,752.00
Schedule 'RP3'							
Tour Advances Paid during the year	22,93,856.00	-	-	22,93,856.00	30,546.00	1,40,94,157.00	1,76,195.00
Adjustment during the year	-	-	-	-	-	-	-
Project No 4803-4	(2,53,186.00)	-	-	(2,53,186.00)	(3,372.00)	-	-
Paid during the year	23,618.00	-	-	23,618.00	315.00	-	-
Amount received in settlement of TA/DA	(1,00,528.00)	-	-	(1,00,528.00)	(1,339.00)	-	-
Amount received in settlement of TA/DA	(2,206.00)	-	-	(2,206.00)	(29.00)	-	-
19,61,554.00	-	-	19,63,760.00	26,150.00	1,40,94,157.00	1,76,195.00	
Schedule 'RP4'							
Amount Released for Seminar during the Year	25,39,200.00	-	-	25,39,200.00	33,813.00	1,40,94,157.00	1,76,195.00
Adjustment during the year	-	-	-	-	-	-	-
Seminar(11-140)	(9,77,760.00)	-	-	(9,77,760.00)	(13,020.00)	-	-
Seminar(Himalaya Region)	50,000.00	-	-	50,000.00	666.00	-	-
Seminar(11-145)	2,09,625.00	-	-	2,09,625.00	2,791.00	-	-
18,21,065.00	-	-	18,11,440.00	21,459.00	1,40,94,157.00	1,76,195.00	



Bansal

Madhu

Murshuman

INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH (IFCPAR)

SCHEDULE ANNEXED TO AND FORMING PART OF THE BALANCE SHEET, INCOME & EXPENDITURE ACCOUNT AND RECEIPT & PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2016

SCHEDULE-J

ACCOUNTING POLICIES AND NOTES ON ACCOUNTS

Organisation Overview

The Indo French Centre for the Promotion of Advanced Research (the Society) was registered on 16th day of April, 1986 under Societies Registration Act, 1860. The Society involves in the activities to (i) promote cooperation between India and France in advanced areas of fundamental and applied scientific research. (ii) develop cooperation by identifying scientist and scientific institutions of India and France. (iii) provide assistance in the form of grants and equipment as well as other appropriate means for the pursuit of advanced scientific research.

A. SIGNIFICANT ACCOUNTING POLICIES

1. Change in Accounting Policy:

- a. **Change in Exchange Rate:** During the financial year 2014-15, for presentation of consolidated accounts, revenue expenditure of Euro version in Receipts and Payments account and Income & Expenditure account were converted to INR and vice-versa on the basis of (1st working day of the quarter) conversion rate of Rupee to Euro as declared by RBI from time to time. Whereas, Assets and Liabilities accounts have been converted to INR and vice-versa at the exchange rate as prescribed by RBI on the Balance Sheet date.

However, during current financial year, for both Revenue expenditures and Assets & Liabilities converted to INR and vice-versa at the rate of exchange prescribed by RBI on the Balance Sheet date.

- b. **Non-core Programmes:** The grant and the expenditure pertaining to the non-core programmes were reflected together with the core programmes up to 31.3.2015. However, during the current financial year, grant for non-programmes has been considered "year marked fund" and accordingly shown in the balance sheet as net of expenditure. Out of the grant for the non-programmes, grant pertaining to overhead & programme implementation charges have been accounted for in income & expenditure account.

2. **Basis of preparation** The preparation of financial statements is as per historical cost convention and Mercantile system of accounting.
3. **Accounting Period:** Financials are reported from 01st April of a year to 31st March of the following year for both Indian Rupees & Euro Transactions.
4. Any surplus of Income over Expenditure carried forward to next year for utilization as per objectives of the Centre.
5. **Grants Awarded:** Grants to an awardee are recognised on the recommendation of the Scientific Council, approval by the Governing Body and with the final approval of both Indian and French Governments. Based on the commitments made to awardees in a year, aggregate grants are recognised as expenditure to the extent of payment made to each awardee during the year. Grants released for various research projects have been shown under the head "Scientific Expenses" in the "Income & Expenditure Account" on the basis of disbursements made by the Centre. First year releases are made on the basis of the approved Budget. However, subsequent releases are made only on receipt of the statement of expenditure of the previous years from the institutions.

All the assets acquired for research projects remain with the institution where the research work is carried on. The Centre has however retained the right to transfer these assets to other institutions, if required, on completion of the projects for which these assets were purchased. The expenditure on these assets has been accounted for in the Income and Expenditure Account under the head "Scientific Expenses". Hence, these assets have not been taken in the Balance Sheet of the Centre.



R

Maitra

Mukherjee

7. **Reporting currency & Foreign Currency Transactions:** The accounting currency of the Society is Indian Rupee and Euro. Separate books of accounts are maintained for recording respective transactions occurring in Rupee and Euro currencies and accordingly separate Receipt & Payment Account, Income & Expenditure Account and Balance Sheet drawn in respective currencies.

For presentation of consolidated accounts, revenue expenditure of Euro version in Receipt & Payment Account and Income & Expenditure account and Assets and Liabilities accounts are converted to INR and vice versa on the basis conversion rate of Rupee to Euro as declared by RBI as on the Balance Sheet date.

8. **Income Recognition:**

Grants-in-aid: Grants received from Department of Science & Technology, Government of India and from Government of France are shown as Grant-in-Aid under the head Income in the Income and Expenditure Account.

9. **Fixed Assets:**

- Fixed assets are stated at gross block less provision for accumulated depreciation. The cost of an asset comprises of its purchase price and directly attributable costs of bringing the asset to working condition for its intended use.
- Depreciation on fixed assets has been provided at the rates and in the manner specified in Income Tax Rules, 1962.

B. NOTES TO ACCOUNTS:

1. **Grants-in-Aid**

- IFCPAR has received a sum of Euro 1.556.177 from Government of France towards grants-in-aid in the financial year 2015-16 for normal activities (core) of the Centre including Euro 6.177 received towards Group Farming Project.
- IFCPAR has received a sum of Rs.13,18,81,192/- as Grants- in-aid from Government of India, Ministry of Science and Technology, Department of Science and Technology during the year for normal (core) activities of the Centre.

2. **Non-Core Programmes:** During the financial year 2015-16, an amount of Euro 333.000 and Rs. 3,33,99,782/- were received from Government of France and Government of India respectively towards Non-Core Programmes of the Centre.

3. **Foreign Currency Adjustment Account**

- Foreign currency adjustment account representing exchange rate fluctuation of Rs. 1,88,09,174/- as on 31.3.2015 has been adjusted against the reserve fund.
- During the current financial year, exchange rate fluctuation of Rs. 86,02,216/- on account of the closing bank balance as on balance sheet date has been reflected in the Balance Sheet as "Foreign Currency Adjustment" Account and exchange rate fluctuation of Rs. 1,80,014/- on account income/expenses have been reflected in the Income & Expenditure account as "Exchange Rate Fluctuation Account".

4. **Fixed Assets:** The assets are presented on gross block basis providing corresponding provision for accumulated depreciation.

5. **Employee Benefits:**

- Gratuity Fund:** No contribution was made to LIC of India towards annual premium for the Group Gratuity Cash Accumulation Scheme maintained with LIC of India for the Financial year 2015-16. However, the matter is taken up with LIC and the same is in process due to change of existing policy recommended by LIC.

- Contributory Provident Fund & Super Annuation Scheme (Pension):** Contribution collected from the Employees of the Centre used to be deposited in the approved IFCPAR Contributory Provident Fund. Since the year 2005-06, Centre had converted Contributory Provident Fund to IFCPAR Pension-Superannuation Scheme and General Provident Fund; this has also been approved

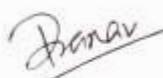


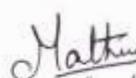
R *Mathur* *MA*

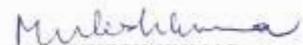
by the Governing Body of the Centre. Corresponding Income Tax benefits for the contributions have been extended to employees. The contribution to LIC for pension policy is under consideration for final decision from the Sub-Committee which met on 30.08.2016 in this regard for the financial year 2015-16 onwards.

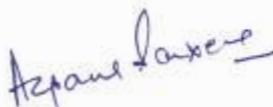
- c. **Committed liability for Leave Encashment:** As on 31st March 2016, liability towards leave encashment for 12 eligible employees amounts to Rs. 46,91,818/-. The leave encashment is accounted for on cash basis and no provision has been made in the books of accounts.
6. **Committed liability for Projects:** During the financial year 2015-16 total ongoing projects were 73 and committed liability towards these projects amounts to Rs . 48,27,74,341/- as on 31st March 2016.
7. **Equipment acquired for Projects:** The Assets acquired by the participating Research Institutions for the ongoing projects of Rs. 4,66,08,787/- as on 31st March 2015-16. are maintained at the respective institutes. The Centre has however retained the right to transfer these assets to other institutions, if so required on completion of the projects for which these assets were purchased. This has been accounted for as "scientific expenses" in the Income and Expenditure account.
8. Assets and Liabilities and Revenue Income and Expenditure have been converted to INR and vice versa at the rate of exchange as prescribed by RBI on the Balance Sheet date, i.e. 31.03.2016, @ Rs. 75.0955 per euro.
9. **Income Tax:** The Centre was granted exemption under section 11(1)(c) of the Income Tax Act for the financial years 2009-10 to 2012-13.
Application for exemption under section 11(1)(c) of the IT Act for the financial years 2013-14, 2014-15 is pending with CBDT. No provision has been made in this regard as the matter is of interpretation of Income Tax Rules which the Centre is contesting.
10. **Prior Period Items :** Few incomes amounting to Rs. 1,55,008/- pertains to the previous financial years which was omitted to be taken into accounts, has now been reflected in financial statement as prior period items.
11. **Related parties Disclosures:** During the year no trust funds were utilized for the benefits of the trustees other than reimbursement of expenses incurred by them.
12. Previous years' figures are regrouped and rearranged wherever necessary to make it comparable.

For **SSAS AND ASSOCIATES**
Firm Registration No. 08550N
Chartered Accountants


PRANAV SHARMA
ASSISTANT ACCOUNTS
OFFICER


MATHEW JOSEPH
ACCOUNTS OFFICER


DR. MUKESH KUMAR
DIRECTOR


ALPANA SAXENA
Partner
Membership No. 095837

Place : New Delhi
Date : 30.09.2016



INDO-FRENCH CENTRE FOR THE PROMOTION OF ADVANCED RESEARCH, New Delhi
RECEIPT AND PAYMENT ACCOUNT IN RESPECT OF IFCPAR GRATUITY FUND FOR THE YEAR ENDED 31ST MARCH, 2016

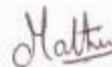
RECEIPTS	AMOUNT (Rs.)	PAYMENTS	AMOUNT (Rs.)
Opening balance			
Balance with State Bank of Hyderabad. IHC	22,32,233.00		
Amount Receivable from IFCPAR towards TDS deducted by Bank on Interest	92,709.00		
		Closing balance State Bank of Hyderabad Savings Bank Account	22,32,233.00
		TDS deducted by Bank on Interest	92,709.00
TOTAL	23,24,942.00	TOTAL	23,24,942.00

The above transactions/balances are included in the Receipt & Payment account of IFCPAR for the year 2015-16

Compiled from the books of accounts
and records as produced before us

For **SSAS AND ASSOCIATES**
Firm Registration No. 08550N
Chartered Accountants


PRANAV SHARMA
ASSISTANT ACCOUNTS OFFICER


MATHEW JOSEPH
ACCOUNTS OFFICER


DR. MUKESH KUMAR
DIRECTOR


ALPANA SAXENA
Partner
Membership No. 095837



Place : New Delhi
Date : 30.09.2016



Indo-French Centre for the Promotion of Advanced Research/ Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA) is a model for international collaborative research in advanced areas of Science & Technology. The Centre was established in 1987 being supported by Department of Science & Technology, Government of India and the Ministry of Foreign Affairs and International Development, Government of France. CEFIPRA is actively involved in supporting Indo-French Science, Technology & Innovation system through various activities. Collaborative Scientific Research Programme focuses on Academia-to-Academia Collaborations between Indian and French Academic Collaborators in various domains. Industry Academia Research & Development Programme emphasizes to develop the linkage between Industry and Academia from France and India. Dedicated mobility support programmes of CEFIPRA provide exposure to young researchers of the working, social and cultural environment of the partnering country. Targeted Programmes of CEFIPRA provide platform for Indian and French National Funding Agencies to implement programmes for specific areas. Innovation programmes through PPP mode, are the programmes where Industries join hands with CEFIPRA as a funding partner for supporting R & D in defined priority areas.



For further information, please contact:

Director
Indo-French Centre for the Promotion of Advanced Research/
Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA)
 5B, Ground Floor, India Habitat Centre, Lodhi Road, New Delhi - 110 003 (India)
 Tel: 011 2468 2251, 2468 2252, 2463 3567, 4352 6261
 Fax: +91-11-2464 8632
 E-mail: director@cefipra.org ; Website: www.cefipra.org