

# ENSEMBLE

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Newsletter of the Indo-French Centre for the Promotion of Advanced Research



## Enhancing Industrial Competency



## editor's note

Appreciating the need of linking knowledge system with wealth creation, CEFIPRA in its evolution process initiated the Industrial Research Programme in 2002 for aligning and strengthening academia-industry collaboration. In this edition, we share significant outputs of four projects that resulted in improvement in industrial processes or development of products resulting in enhanced competencies of the industries. In order to strengthen this programme, CEFIPRA has recently announced a Special Call for Proposals in the domains of Automotives, Aerospace Engineering and Ancillary industry. The last call that focused on Catalysis, Biotechnology, Diagnostics and Engineering had received good response from the industries and academia of both the nations.

In order to catalyze the upper end of the knowledge innovation chain, a meeting was organized between Technology Development Board (TDB) and bpiFrance (earlier OSEO) in Paris on 9th July 2013. The sectors of Automotive, Aeronautics and Biotechnology have jointly been identified as areas to be supported under this collaboration. We are planning to bring SMEs from both the nations together in these sectors for developing collaboration. India-France Technology Summit, to be organized during 23rd and 24th October 2013 in New Delhi, is providing the motivating platform for fructification of these efforts.

During this period, Indo-French S&T Ecosystem has been strengthened further through selection of four projects in the area of Infectious diseases and Engineering Sciences under the targeted Collaborative Research Programme between ANR & DST. We have recently announced the 2nd joint call for proposals under this targeted programme in the areas of Neurosciences and Engineering Sciences. Mobility, an important pillar of bilateral S&T cooperation, has been enhanced by supporting the visit of 25 scientists and eight students between India and France during the last two months.

We are happy to report continued support from both the Governments as evidenced by the encouragement provided by H.E. Monsieur François Richier, during the luncheon meeting with the representatives of Indian S&T ministries and departments and the visit of French Senators.

We will continue to inform you about our efforts of catalyzing across the knowledge innovation chain.

Thank you all! Merci Beaucoup!



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## Industrial Research Program

# Enhancing Industrial Competency

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Each country desires that as much of its research as possible gets converted into economic activity and job creation. It also encourages utilization of tacit knowledge for improving existing products and processes. This is equally true for both India and France, which had already been having formal scientific collaboration in basic research involving scientists from both the countries since late eighties.

To manage this collaboration, they started a special institution, CEFIPRA, which supported basic research through project mode. These collaborations have been exceptionally successful and have resulted in large number of publications in top quality journals.

After achieving this phenomenal success in collaborative research, the Governing Body of CEFIPRA decided to extend the basic research collaboration to those areas of R&D which are more directly connected with economic activity. This took the shape of "Industrial Research Collaboration" with the specific goal of using scientific expertise of one country for the benefit of the industry of the other country by enhancing its technological performance through making it internationally more competitive.

The major collaborators of this programme are the scientific institutions which would provide knowledge and the industrial enterprises which would use this knowledge. Therefore, the minimum requirement for this programme was a collaboration between an industrial enterprise of one country with a scientific institution of the other. The programme encouraged participation of more and more industries and scientific institutions of both countries.

### NATURE OF PROJECTS

The projects under this category had very special requirements. Firstly, they had to be industry centric and had to originate from the industrial enterprise. This

involved development of modified products/processes or entirely new ones.

The developmental work was to be conducted by the scientific institution whereas its validation and translation to commercial stage was to be taken up by the industrial enterprise.

The projects selected were not only had to be industrially viable but also capable of reaching the stage of commercialization within a period of 3 to 5 years.

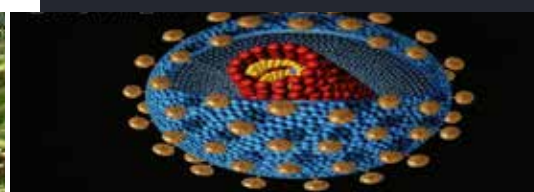
CEFIPRA provided financial support primarily to the scientific institution, though it could give limited support to industrial partner also, under special circumstances.

The benefits of research were to be shared between the participants in a fashion decided by them jointly. The Centre was to be kept informed which ensured fairness to all participants.

There was no constraint of areas in which projects were entertained. As a result, projects diverse areas like Biotechnology, Chemicals and Pharmaceuticals, Solar Energy, Polymer degradation, Particulate Measurement and IT have been handled among others over a period of around 10 years. A major recent success that merits a special mention has been the development of a modified process for the manufacture of one of the prostaglandins. This has moved from the lab scale to commercial production and marketing. Such is the demand for this production that the industry involved is setting up a stand alone facility for its manufacture.

### OPERATION OF THE PROGRAMME

CEFIPRA has set up a special committee called Industrial Research Committee (IRC) which proactively seeks proposals, gets them peer reviewed, recommends support, and follows them up (even after the project period is over)



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OSEO (now bpiFrance) helps in identifying appropriate clusters, enables visits of IRC members to various clusters. It is of great help in identifying problems of potential commercial interest. Such meetings have shown much greater success in identifying projects of industrial relevance.

vi) Yet another recent initiative taken by CEFIPRA to identify new projects is through open advertisements released in identified publications. It has already started yielding good results, as a positive response has been noted up to this time.

In spite of the multi-pronged proactive efforts, the success rate of identifying projects and participants continues to need more effort.

### EVOLVING PROGRAMME

All the projects handled earlier considered commercialization as the only end point, irrespective of the starting stage (between invention to innovation). However, both business and technology continue to evolve during the project. The industry, many a time, finds it unprofitable to pursue the successful laboratory development to commercial level. Realising that invention to innovation chain is a long one and involves a number of stages, CEFIPRA has recently expanded into industrial research activity to include each step of the innovation chain as a legitimate stand alone goal to be achieved. It is now supporting various stages like proof of concept, development of invention, converting invention into prototype etc. as separate projects. Though a project at intermediate stage may not immediately result in commercialization, it takes the technology a step towards eventual commercialization. IRC is always striving to ensure that each project has the long term end goal as commercialisable.

It is also planning to introduce Public-Private Partnership models involving a single industry or an agglomeration of industries to achieve wider goals involving series of projects in which industry and CEFIPRA make joint contributions.

It is hoped that along with the old programme of CEFIPRA which is slowly becoming more focused and industry centric along with the new initiatives of supporting research at all stages of development will significantly enhance the potential of this programme in terms of economic activity and job creation. Industrial Research Program is an evolving one and is likely to undergo further innovative changes which will make it even more effective and sustainable as time goes by. ●

till the commercialization stage. The projects are received throughout the year, whereas the IRC meets twice a year to take decisions about financial support.

### PROACTIVE GENERATION OF THE PROPOSALS

The key challenge of these projects is not only to identify the industry but also the scientific institution where the requisite expertise is present and bring the two together. CEFIPRA has used many tools to achieve this.

- i) Some of the projects are natural extension of the proof of concept which has been achieved during the basic research project. Such projects are relatively easy to identify.
- ii) Many scientists participating in the basic research projects also act as consultants to industry and hence have knowledge of the problems the industry is facing. CEFIPRA appoints such scientists as resource persons to identify both the industry and the nature of the problem needing resolution.
- iii) Some enterprises approach the CEFIPRA on their own after going through its activities on the internet or through other means.
- iv) Some persons with long working experience in industry, who are aware of the problems faced by the enterprises in their areas of expertise are also roped in as resource persons.
- v) The major procedure followed by the CEFIPRA to identify not only the problems, but also potential industrial enterprises and scientific partners, is through organization of special seminars and workshops. In these, specially selected enterprises and scientific institutions from both the countries are brought together to have one to one discussions, apart from presentation of specific problems faced by the industry.

The effectiveness of this procedure has been significantly enhanced by identifying participants in specific areas in France from clusters in the area of interest. Enormous benefit has been drawn by the CEFIPRA from building contact with clusters.



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Over the years, the activities of IRC Program have witnessed a sustained growth. This is not only in terms of the number of projects supported under the program but also in terms of their spread across various domains. The Industrial Research Committee (IRC) is currently steering more than 18 projects involving industries from pharma, biotechnology, chemical, healthcare, software, environment and several other sectors.

The path leading to the current situation has been quite difficult. This was especially due to the fact that the funds available per project are limited and also because in a collaborative framework CEFIPRA can financially support only the academic partner (except for exchange visits). Another constraint was the weak links of the Indian academia with French academia/ industry when the program was launched. To overcome these hindrances IRC members had to proactively engage with the Indian & French industries to encourage them for appropriate project formulation, as well as to help the Indian & French industries to identify suitable academic partners as per need. This was in addition to efforts aimed at evolving suitable IP management and sharing regimes and monitoring the projects on a quarterly basis.

IRC initiated a number of steps aimed at popularising the programme among French and Indian industrial entities. Conduct of industry oriented seminars which allowed industries and academia from both countries to come together and share their ideas on a focussed topic was very helpful. IRC members visiting Technopoles in France with a view to familiarise with the tenants of that pole (industry, academic) with the program and encouraging delegations to visit India to identify suitable partners for collaborative R&D also led to formulation of a number of useful projects.

IRC evolved many other innovative mechanisms to attract quality project proposals to achieve its mandate. Constraints related to funding and several other aspects forced

*(Contd. on page XIV.)*

Although everybody agrees that the main breakthroughs of scientific innovation originate through efforts in basic research, their transposition into innovative processes or products is not as straightforward. Large national or international research institutions, like CERN or space organisations, demonstrate that technological developments requested by their own needs also rapidly benefits many other sectors. The smaller disciplinary projects, such as those initially supported by CEFIPRA could not claim such outcomes. Nevertheless, the financing governments were able to justify in part their expenses by demonstrating a direct link between the supported research project and their potential applications, and their contribution to the economic and social progress. Without imposing a given percentage, the Governing Body therefore expects a fraction of the total research budget to be devoted to “industrial projects”.

The first move of CEFIPRA in this direction was to encourage PIs to proactively collaborate with industry to commercialise viable innovations. Mimicking basic research projects, new project grants stipulated involvement of at least one industry and a laboratory (one from each country) in every project. The build-up of successful projects between industry and academia takes some time and generally relies on the development of networks of scientific and technical professionals. CEFIPRA has actively encouraged this. The standard partnership framework for CEFIPRA’s “industrial projects” has thus been one industry from either country and two labs, one from each country. This framework was adopted as a strategy to exploit the complementary skills of a lab to foster an existing industry.

There were however a number of drawbacks. The lab connected with Industry in one country could convince its usual industrial partner to apply with him and another lab in the other country, with no real commitment to the development of an economically viable product or process. At the time the members of the Scientific Council

*(Contd. on page XII.)*

## MISOPROSTOL - A BREAKTHROUGH FOR WOMEN'S HEALTH



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RU 486 (Mifepristone) is an anti-progesterone drug for fertility control that detaches the embryo from the uterus by blocking the hormone progesterone. As strong uterine contractions are required for complete expulsions of the embryo and endometrial lining, a prostaglandin derivative, Misoprostol, is administered after 24 hours to complete the process of abortion.

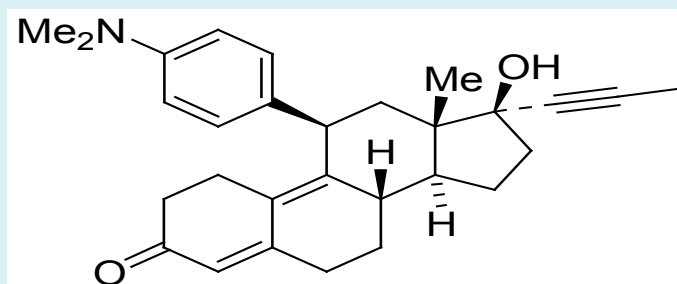
AVRA Laboratories Pvt. Ltd. (AVRA) caters to the needs of pharma/ biotech companies by providing high value chemical research services. AVRA initiated work on the process development for the production of RU 486 (Mifepristone) on the advice and persuasion of Prof. Sune Bergstrom (Nobel Laureate 1981). AVRA optimized the process for the production of Mifepristone, starting from estrone (supplied by Prof. Bergstrom). However it could not take up its production due to financial constraints. Investment by Zydus Cadilla helped AVRA to produce RU 486 exclusively for Zydus Cadilla which would formulate and market the product. While this paved the way for the production of RU 486 by AVRA at its Nacharam facility in 2003, Misoprostol still had imported (to be supplied along with Mifepristone) and was expensive.

In year 2005 AVRA proposed that CEFIPRA support a project aimed at optimising the production process of Misoprostol so as to reduce its production costs given the fact that Misoprostol an essential drug with a growing global demand. CEFIPRA assigned the project to Indian Institute of Chemical Technology (IICT), Hyderabad with Dr. J. S. Yadav as the PI, Dr. S. Chandrasekhar as Co-

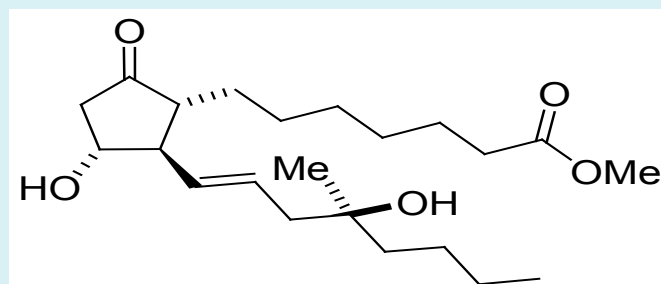
investigator. Prof. Renne Gree of the University of Rennes represented the French side. After more than years of effort IICT successfully produced 1gm of the compound through the synthetic route. AVRA stepped in at this stage and scaled up the production process after optimizing every step and improving the purity profile. The main challenge was to get the final product after dispersing the highly pure form (which is very sensitive and unstable) onto a support that renders it stable. Stabilization was achieved by dispensing 1% of Misoprostol on Hydroxy-Propyl Methyl Cellulose (HPMC). AVRA efforts led to pilot trials which were carried out to produce 10 kg batches.

On conclusion of the stability studies the product was launched in the Indian market in September, 2011. AVRA now produces 100 kg/month of the drug and offers it to several national and international pharma companies. Steps to double the production capacity are now underway by way of setting up a GMP facility at Vizag, Andhra Pradesh that involves an investment of Rs. 500 lakhs.

Misoprostol can be used to induce a safe abortion, to treat incomplete miscarriage, induce birth and to prevent heavy bleeding after giving birth. Misoprostol works by causing uterine contractions, inducing labour and softening & dilating the cervix. Every year about 42 million women undergo an abortion either with Misoprostol alone or in combination with Mifepristone. Misoprostol tablets are on the essential list of medicines of the World Health Organization (WHO) Dispensed as 100/200 mg tablets. It is now inexpensive and widely available world wide. ●



Mifepristone (RU 486)



Misoprostol

## ENZYMES PURIFICATION AND STABILIZATION TECHNOLOGIES



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Restriction enzyme digestion takes advantage of naturally occurring enzymes that cleave DNA at specific sequences. There are hundreds of different restriction enzymes, allowing scientists to target a wide variety of recognition sequences. Many applications also require antibodies to be purified to obtain the best results. The cost of purifying restrictive enzymes and antibodies is significant in the sense that it puts Indian manufactures at a disadvantage.

Under this project supported by CEFIPRA under the aegis of its Industrial Research Program the focus was on developing more efficient and cost effective purification strategies for restriction enzymes antibodies etc. The challenge was to optimize the cost of producing restriction enzyme BamHI so as to successfully compete with manufacturers from other parts of the world.

CEFIPRA brought us together with Bangalore Genie, an SME facing difficulties in getting pure and stable BamHI employing conventional methods of chromatography. My group at Universite de Technologie (UTC) was developing some cutting edge ultra high-performance chromatographic systems based on pseudo-bio-affinity recognition for purification of structurally intact protein molecules ensuring functional properties. High purity and high yield of products could be achieved through these cost-effective approaches.

The objective of this collaboration was to work out an efficient method to recover and purify the restriction enzyme BamHI from the bacterial culture media producing this enzyme. We were able to successfully recover and purify stable enzyme using our novel high-throughput chromatographic system – using convective interaction media (CIM) technology combined with pseudo-affinity ligand.

We were able to get 20,000 units of BamHI using our innovative system with a run time of only 40 seconds, while the purification on conventional soft gel system (2 ml column) took about 120 min for achieving 24,000 units of the same enzyme. The quality of the final product was identical to, and comparable with, the commercial product supplied by New England Biologicals (NEB) which was used as reference.

This fast and efficient purification strategy was successfully integrated into the existing restriction enzyme production system of Bangalore Genie. In addition a senior member from Bangalore Genie was also trained at UTC for a period of six months in different cutting edge chromatographic approaches such as immobilized metal affinity chromatography (IMAC), histidine and affinity chromatography (HLAC) etc. which could be used beyond this specific problem. ●

## DST-ANR JOINT CALL FOR PROPOSALS

Department of Science and Technology (DST) and Agence Nationale de la Recherche (ANR) invite pre- proposals for collaborative research for the year 2014. In India, on behalf of the DST CEFIPRA invites pre-proposals from the Indian scientists / researchers under this targeted program.

**Thrust areas of research for this call are:** a) Neurosciences, b) Engineering Sciences (Sub-areas: Material Science, Chemistry, Intelligent Transport System and Energy) PI's of shortlisted pre-proposals will be requested to submit full proposals. The research projects will be funded for a maximum of three years. For more details regarding application procedure & format, funding mechanism, proposal evaluation process and criteria please visit [www.cefipra.org](http://www.cefipra.org), or contact:

**A Sathidevi**

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Proposal Submission Deadline | **23 October 2013**



## OPTIMISATION OF AN ANAEROBIC FIXED BED REACTOR



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Anaerobic digestion is a biological process used for pollution removal from domestic or industrial wastewater and for solid waste management. This process is widely used in wastewater treatment as it presents several advantages compared to the competing aerobic biological treatments. This includes less energy requirement lower production of excess sludge, and, production of biogas (70 % CH<sub>4</sub> – 30 % CO<sub>2</sub>) that can be used for energy production.

In the year 2000, INRA-LBE had developed a new technology called PROVEO which can be classified as an “anaerobic fixed bed reactor” after five years of intensive research and development. This process made it possible to maintain a high quantity of active micro-organisms inside the reactor. This was through the use of a plastic inert biomass carrier (Bioflow 30) filling the major volume of the digester, which allowed reaching consistently overwhelming performances. During normal operations, the carriers are motionless and the reactor works as a fixed bed. However, occasional fluidization is required from time to time to unclog the bed and remove the excess sludge which has accumulated. This process was patented in 2005 (Patent N° 0551092) and a licence on know-how was signed between INRA and the French company NASKEO for its marketing. However, the carrier used had some drawbacks which required further improvement of the technology to enhance the competitive advantage of the PROVEO process. This necessitated manufacturing new types of carriers for experimental purposes. It was very difficult to find a supplier able meet to requirements at reasonable costs in France. Kumaraguru College of Technology (KCT) in Coimbatore had established contacts with the Indian industry “Wintex”, also in Coimbatore. Wintex was able to manufacture different designs of carriers made-up of different materials at an acceptable cost for lab-scale and further pilot-scale experiments.

The project supported by CEFIPRA aimed at optimizing the PROVEO process by designing, testing and implementing innovative and industrially adequate inert carriers with improved performances compared to Bioflow

30 in terms of hydrodynamics, material and specific area. The project had two parts. The first part aimed at evaluating the best material for the inert carrier. The second part aimed at designing the optimal shape of the carrier for our application. Wintex produced eight different carriers. Four with the same shape but made of different materials and four with the same material but with newly designed shapes. Experiments were carried out both at KCT and INRA-LBE at laboratory-scale (10-L reactors) and at pilot-scale (1.2 m<sup>3</sup> reactor). Among the people involved in this project, two Indian post-docs spent 8 months at INRA-LBE to pursue experiments at laboratory and pilot-scale.

From a technical point of view, the project was fully successful and a new carrier was developed with a behaviour better than Bioflow 30. However, there are no industrial applications at the moment as the context of anaerobic digestion in France has changed a lot during the duration of the project. Strong financial incentives are offered by the French government that favour the development of renewable energy production from anaerobic digestion of solid waste. For these reasons NASKEO has focussed most of its strengths on this thematic preferably to wastewater treatment. ●



## TECHNOLOGY TRANSFER OF A DEPOSITION PROCESS TO SOLAR ENERGY CONVERSION INDUSTRIES



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The project aimed at the transfer of a process of deposition of hydrogenated amorphous silicon (a-Si:H) thin films based on argon dilution of silane in a radio-frequency powered plasma enhanced chemical vapour deposition (RF-PECVD) system toward solar energy industries. Our studies have shown that it is possible to deposit device grade hydrogenated amorphous silicon thin film in a single chamber industrial machine (Nextral 200) over a large area of about 10x10 cm<sup>2</sup>. Different dilutions of silane into argon were tested (10%, 5%, 3% and 1%). However, several difficulties were faced in this course as the deposition of first films indicated some contamination. As we later found out, this contamination had actually originated from the aluminium of the walls and electrodes of the deposition machine. The films deposited in a stainless steel chamber under the same deposition conditions did not exhibit any contamination. Secondary Ion Mass Spectroscopy clearly demonstrated that aluminium was present in some films in a concentration up to 1 ppm. This led to hydrogenated silicon thin films being slightly p-doped making them unsuitable for incorporation in solar devices. We investigated on the possible solutions that could help avoid this contamination.

The first attempt, where we covered the walls with a dummy layer of hydrogenated silicon revealed unfruitful results as the aluminium diffused through this layer and eventually ended up on the deposited films. A more suitable method was to deposit a silicon nitride layer over the walls of the chamber prior to the deposition of the a-Si:H film. A thin layer of silicon nitride prevented aluminium diffusion from the walls towards the plasma and ultimately towards the deposited film. The first depositions of the silicon nitride thin films were achieved by introduction of a small amount of ammonia into the gas mixture. However, since ammonia gas is not easy to handle on an industrial scale, we tried to replace ammonia by nitrogen gas which is very common and easy to handle. We succeeded in depositing a silicon nitride



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layer from a mixture of silane and nitrogen that protected the a-Si:H films deposited subsequently. This method to protect a-Si:H from aluminium walls contamination during deposition was proposed as a patent. However this patent was not registered because of the view that there are no possibilities of control of the use of this process by a manufacturer.

In addition to this research work aimed at controlling contamination, we also tested different deposition conditions. Results show that high dilution of silane into argon yields device grade materials and rather stable devices. The best conditions were 3-5% of silane diluted into 97-95% of argon leading to devices with a conversion efficiency of the order of 7% for 10x10 cm<sup>2</sup> solar modules. ●

**NEW SCIENTIFIC COLLABORATIVE RESEARCH PROJECTS**

April - July 2013

Domain	Project	Objective	Indian PI & Institution	French PI & Institution
Life and Health Sciences	<b>Integrating Hox and chromatin mediated transcriptional regulation</b>	To understand how chromatin regulators impact on transcription factor function, by studying the sequence specific transcription factors and general chromatin regulators to regulate transcription.	 <b>Rakesh K Mishra</b> Centre for Cellular and Molecular Biology, Hyderabad	 <b>Yacine Graba</b> Institute for Developmental Biology Marseille Luminy, Marseille
	<b>Transcriptomics and metabolomics in patients with steroid non-responsive severe alcoholic hepatitis</b>	To gain insights into molecular mechanisms that are associated with response to corticosteroids by using gene- and exon-expression profiling and metabolomics profiling. Gene/exon-expression profiling in the liver and peripheral blood mononuclear cells (PBMCs) as well as metabolomics profiling in the liver, plasma and urine, will be performed at baseline (i.e., before stating corticosteroids)	 <b>Shiv Kumar Sarin</b> Institute of Liver and Biliary Sciences, New Delhi	 <b>Richard Moreau</b> INSERM U773, Paris
	<b>Global transcriptomics of sex specific splicing</b>	To characterize and compare the sex specific splicing of pre-mRNAs via high throughput sequencing of cDNAs(RNA-Seq) in two insect species, a male heterogametic system( <i>Drosophila melanogaster</i> ) and a female heteogametic system( <i>Bombyx mori</i> ). Also, to analyse the novel molecular players involved in sex determination in these two insect model systems.	 <b>K. P. Arun Kumar</b> Centre for DNA Fingerprinting & Diagnostics, Hyderabad	 <b>Leonard Abinow</b> Centre de Neurosciences de Paris Sud, Orsay
Pure and Applied Physics	<b>Studies of spin ladder and heavy fermion systems in extreme conditions of hydrostatic or uniaxial pressure and low temperature</b>	To 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. The objective of the project is to understand of the physics of the novel and competing orders that exits in two different families, namely spin ladder and heavy fermion systems and to develop and perform measurements under hydrostatic and uniaxial pressure.	 <b>S. Arumugam</b> Bharathidasan University, Tiruchirappalli	 <b>Daniel Braithwaite</b> Institut Nanosciences et Cryogénie, Grenoble
Earth and Planetary Sciences	<b>Tropical cyclones in the Bay of Bengal: Oceanic response and air-sea interactions</b>	To understand the ocean response and air-sea coupling under tropical cyclones (TC) in the Bay of Bengal. Quantify the influence of salinity stratification on the amplitude of TC-induced chlorophyll blooms and surface cooling, using a ocean model. Develop statistical prediction schemes in this region in order to quantify the skill improvement brought by accounting for ocean-atmosphere interactions under TCs.	 <b>S. Neetu</b> CSIR-National Institute of Oceanography, Goa	 <b>Matthieu Lengaigne</b> Laboratoire d'Océanographie et de Climatologie: Experimentation et Analyses Numériques, Paris

**VISITS OF SCIENTISTS SUPPORTED UNDER CEFIPRA PROJECTS**

May - July 2013

S. No.	Project Title	Name   Institutional Affiliation	Institute Visited
1	<b>Adaptation of Irrigated Agriculture to Climate Change</b>	<b>Dr. Shrinivas Badiger</b> ATREE, Bangalore	Laboratoire d'Etudes en Geophysique et Oceanographie Spatiales, Toulouse
2	<b>Shaping of Durable, Thermal Shock Resistant High Volume Ceramic Containers</b>	<b>Dr. Y.S. Rao</b> ARCI, Hyderabad	P.A.C.T, Limoges
3	<b>High Anisotropy Molecular Magnets: Synthesis and Modelling</b>	<b>Prof. Ramasesha</b> Indian Institute of Science, Bangalore	Laboratoire de Chimie de Coordination, Toulouse
4	<b>Deep Structure of the Indian Continent</b>	<b>Dr. Ravi Kumar</b> National Geophysical Research Institute, Hyderabad	Institut de Physique du Globe, Paris
5	<b>Deep Structure of the Indian Continent</b>	<b>Dr. Prakash Kumar</b> National Geophysical Research Institute, Hyderabad	Institut de Physique du Globe, Paris
6	<b>Interstellar and Intergalactic Medium at High Redshift: Reservoir for Galaxy Formation</b>	<b>Dr. R. Srianand</b> Inter Univ. Centre for Astronomy and Astrophysics, Pune	Institut d'Astrophysique, Paris
7-8	<b>Arithmetic Circuits Computing Polynomials</b>	<b>Dr. Nutan Limaye   Dr. Srikanth Srinivasan</b> Indian Institute of Technology, Mumbai	Institut Mathématique de Jussieu, Paris
9-10	<b>Mineral-fluid Interaction Model for CO<sub>2</sub> Sequestration</b>	<b>Dr. Tapati Dutta   Dr. Sujatha Tarafdar</b> St. Xavier's College, Kolkata	Université de Montpellier, Montpellier
11	<b>Correlated Studies of Response Properties of Open-shell Molecules in the Relativistic Framework</b>	<b>Dr. Debasis Mukherjee</b> Indian Association for the Cultivation of Science, Kolkata	Laboratoire de Chimie et Physique Quantiques, Toulouse
12	<b>Biological peroxide sensing: The Bacterial Regulator PerR, Synthetic Analogues and Biomimetic Reactivity</b>	<b>Prof. M. Palaniandavar</b> Central University of Tamil Nadu, Thiruvavur	Laboratoire de chimie et Biologie des Méaux, Grenoble
13	<b>Analytic Aspects of Modular Forms</b>	<b>Prof.C.S. Rajan</b> Tata Institute of Fundamental Research, Mumbai	Institut Elie Cartan, Vandœuvre Nancy
14	<b>Tropical cyclones in the Bay of Bengal: Oceanic Response and Air-sea Interactions</b>	<b>Dr. Neetu Singh</b> CSIR-National Institute of Oceanography, Goa	Laboratoire d'Océanographie et de Climatologie: Experimentation et Analyses Numériques, Paris
15	<b>Gene Resources from Polluted Soils</b>	<b>Dr. M. Sudhkar Reddy</b> Thapar University, Patiala	Université Lyon 1, Villeurbanne
16	<b>The Kosi River Alluvial Dynamics and Associated Risks</b>	<b>Dr. Debajyoti Paul</b> Indian Institute of Technology, Kanpur	Institut de Physique du Globe, Paris
17	<b>Extreme QCD in the LHC Era</b>	<b>Dr. Rajeev Bhalerao</b> Tata Institute of Fundamental Research, Mumbai	Institut de Physique Théruqye, Gif-sur-Yvette
18	<b>Kleinian Groups: Geometrical and Analytical Aspects</b>	<b>Dr. Mahan Mitra Mj</b> Ramakrishna Mission Vivekananda University, West Bengal	Laboratoire Emile Picard, Toulouse
19	<b>Thermo-hydrodynamics of phase-change induced oscillating Taylor bubble flows</b>	<b>Mr. Vyas Srinivasan</b> Indian Institute of Technology, Kanpur	Centre de Thermique de Luon, INSA de Lyon, Villeurbanne
20	<b>Distant Obscured Galaxies from GMRT and Herschel</b>	<b>Dr. Yogesh Wadadekar</b> National Centre for Radio Astrophysics, Pune	Institut d'Astrophysique Spatiale, Orsay
21	<b>Collective Migration in the Fly Nervous System</b>	<b>Dr. K. VijayaRaghavan</b> National Centre for Biological Sciences, Bangalore	Institut de Génétique et de Biologie Moléculaire et Cellulaire, Ilkirch
22	<b>Development of Carbon Nanotube-metal Hybrid Catalysts</b>	<b>Dr. Irishi N N Namboothiri</b> Indian Institute of Technology, Mumbai	CEA Saclay, Gif-sur-Yvette
23	<b>Extreme QCD in the LHC Era</b>	<b>Dr. Sourendu Gupta</b> Tata Institute of Fundamental Research, Mumbai	Institut de Physique Théruqye, Gif-sur-Yvette
24	<b>Compact Modeling of Asymmetric Double Gate Nano Scale Transistors</b>	<b>Prof. Costin Anghel</b> Institut Supérieure d'Electronique de Paris, Paris	Indian Insttute of Science, Bangalore



**MEETING WITH AMBASSADOR OF FRANCE TO INDIA**

3 June, 2013 | New Delhi

Beyond 25 years, in its expanded mandate, CEFIPRA seeks to position itself in a catalysing role for all the segments of the knowledge-innovation chain from linking various components of the ST& I ecosystem of the two countries to foster people-to-people interactions. This requires inputs and active cooperation of our various stakeholders. For this is required a clear and correct understanding of each other's expectations given the complexity of S&T collaborations and the resources and time they require to get off the ground.

In order to deliberate upon various dimensions of the evolving collaborative Indo-French R&D framework, a luncheon meeting was hosted by the French Ambassador to India, Mr. Francois Richier at New Delhi on 3 June 2013.

The meeting was attended by Dr. Arabinda Mitra, Advisor & Head, International Cooperation(Bilateral), Dept. of Science and Technology (DST); Dr. Veronique Briquet-Laugier, Science Counsellor, French Embassy; Dr. Amitava Bandopadhyay, Chief Scientist & Head, International S&T Affairs Directorate, Council for Scientific and Industrial Research; Dr. A.K. Garg, Dept. of Information Technology (DietY); Dr. Swati Basu, Director, National Centre for Medium Range Weather Forecasting; Mr. Niraj Kela, Director (F&A), Technology Development Board; Dr. Mukesh Kumar, Indian Council for Medical Research; Mr. Rajiv Kumar, DST; Dr. Debapriya Dutta (Director), Mr.V.V. Rao, Mr. R. Murali, Mr. Davinder Kamboj and Mrs. A. Sathidevi, CEFIPRA.

After detailed deliberations and inputs from representatives of various stakeholder agencies present at the meeting



it was decided to have wider consultations on tools and mechanisms that need to be put in place in order to realize the new mandate of CEFIPRA. It was suggested that for a start, CEFIPRA should develop close cooperation with DeITY to foster Indo-French collaboration in High Performance Computing. It was also suggested ICMR can take forward Indo-French efforts in the area of Metabolic Disorders. The meeting also reviewed the preparations for the forthcoming Technology Summit 2013 for which France has been designated as the partner country. There was a consensus that this event offers an enormous opportunity for developing even closer ties between their Small and Medium Enterprises (SMEs). It was decided to organize, an Indo-French SME conclave as a side event during the event. CEFIPRA shall work closely with the French Embassy at New Delhi and CII to make this happen. ●

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in charge of these special projects, namely Pr R. Kumar and Pr M. Fayard, replaced later by myself, were installed into a formal Industrial Research Committee (IRC) of four members. It was clear, that on one hand, projects directly related to previous basic research granted by CEFIPRA were not sufficient sources of industrial projects. On the other hand, the new projects should be written by the industrial partner as a proof of its commitment and for proper planning of the operational segment to be performed by the industry.

In fact, more than previous basic research, the intellectual and instrumental competencies present in the labs appear to be the principal assets of main interest to industrial partners. This shifted the role of IRC from selection to instigation, engineering and monitoring of









new projects. IRC members used their involvement in project reviews, industrial linkages of PI's of earlier basic research projects, their own industrial networks to ascertain existing or potential requirements of the industry. Devoting a small fraction of the CEFIPRA seminars to development of applications was another way to establish contacts and initiate new proposals from informal conversations. However, several difficulties had to be overcome. Long delays (often related to IP matters) in funding decisions were also a serious constraint. This was especially critical in projects where the envisaged grant to academic partners was a small fraction of the planned investment by the industry. Duration of project support was an important factor in domains like biology and health, where the project duration and financial envelope were often incompatible with

**TARGETED COLLABORATIVE RESEARCH PROGRAMME**

BETWEEN DST-ANR 2013

CEFIPRA has initiated the Targeted Collaborative Research Programme to provide a platform for the national agencies from India and France to collaborate in focussed areas. Call for proposals for first such targeted programme between Department of Science and Technology (DST), Government of India and Agence Nationale de la









Recherche (ANR) was launched in October 2012. Against the call, 46 common project proposals were received in the areas of Infectious Diseases and Engineering Sciences. In July 2013 a Joint Selection Committee has selected the four projects from the infectious diseases and engineering sciences categories for support. ●

Infectious Diseases				
Title	Indian Coordinator		French Coordinator	
Soluble mediators of the immune system against <i>Aspergillus fumigatus</i>		<b>Dr. Arun Sahu</b> National Centre for Cell Science Pune		<b>Dr. Vishukumar Aimanianda</b> Unité des Aspergillus Institut Pasteur Paris
Unravelling new functions for the H-NS family of proteins in Gram-negative bacterial pathogens		<b>Dr. J. Gowrishankar</b> Centre for DNA Fingerprinting and Diagnostics Hyderabad		<b>Dr. Sylvie Rimsky</b> Ecole Nationale Supérieure (ENS) Cachan
Engineering Sciences				
Title	Indian Coordinator		French Coordinator	
Complex oxide nano-crystalline systems for chemical sensors		<b>Dr. N. Venkataramani</b> Indian Institute of Technology- Bombay		<b>Dr. Antoine Barnabe</b> Université Paul Sabatier Institut, Carnot Toulouse
Dense particulate systems		<b>Prof. Prabhu R Nott</b> Indian Institute of Science Bangalore		<b>Dr. Elisabeth Guazzelli</b> Aix Marseille University Marseille

requirements. "Competitiveness Clusters" that gather industries, research laboratories & universities of a given territory and in a given S&T domain are a game changer. These clusters have helped to push innovations towards commercially viable products and services through a swift determination of collaboration needs with organisations, inside or outside the cluster. Visits to such clusters by the Industrial Research Committee, together with an Indian domain expert, can potentially initiate several "industrial projects". If such clusters were to exist in India, domains of common industrial interest would certainly be easier to define.

Even though revenues of patent licenses and other royalties from IRC projects may appear small in comparison to the investments, this does not undermine the benefits that accrue from "industrial projects" as they expose S&T systems, training institutions and industries of one country to those in the other. I am confident that linkages between individuals and institutions contribute immensely to the development of S&T collaboration between our two countries. ●

**STUDENTS VISITS SUPPORTED BY CEFIPRA**  
May - July 2013

Domain	Name & Institute		Domain	Name & Institute	
Computer Science		<b>Dr. Bhagyesh V Patil</b> Indian Institute of Technology, Mumbai <u>Institution visited</u> Laboratoire d'Informatique de Nantes-Atlantique, Nantes	Materials Science		<b>Dr. Jayanta Kumar Bal</b> Universite du Maine, Le Mans. <u>Institution visited</u> Universite du Maine, Le Mans
Materials Science		<b>Dr. Arun Kumar Bar</b> Indian Institute of Science, Bangalore <u>Institution visited</u> Laboratoire de Chimie de Coordination Toulouse	Pure and Applied Physics		<b>Mr. Swapnesh Panigrahi</b> Tata Institute of Fundamental Research, Mumbai <u>Institution visited</u> Institut de Physique de Rennes, Rennes
Life and Health Science		<b>Dr. Kaluvu Balaraman</b> IIT - Madras, Chennai <u>Institution visited</u> Université Paris Sud Châtenay-Malabry	Life and Health Sciences		<b>Mr. Ankush Auradhkar</b> Auradhkar, Hovetorpsgatan 22 Lgh 1202, 58735 Linkoping <u>Institution visited</u> IBDML, 13288 Marseille
Pure and Applied Chemistry		<b>Dr. Soumen Samanta</b> Bhabha Atomic Research Centre, Mumbai <u>Institution visited</u> Interfaces, Traitements Organisation et Dynamique, Paris	Laboratoire de Chimie et Physique Quantiques		<b>Ms. Sangita Sen</b> <u>Institution visited</u> Indian Association for the Cultivation of Science Kolkata 700032

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IRC to choose projects characterised that are largely by incremental innovations. This limitation can be overcome if the funds available per IRC project is increased substantially or, by linking up with other agencies providing soft loans and grants to industries. Modalities for engaging French and Indian start-up companies need to be evolved. IRC of CEFIPRA should also encourage Indian industry delegations to visit the appropriate Technopoles in France so that the Indian industry representative can interact with counterpart industry and academic players in the Technopole and evolve joint IRC projects. Similarly, French industries should also be allowed to interact with Indian industry and academia through an appropriate mechanism. ●

**Forthcoming Events**

- September 23-26, 2013, Bangalore, India Seminar on "Dynamics of Earth and Planetary cores"  
E-mail : [director@cefipra.org](mailto:director@cefipra.org)
- October 23-24, 2013, New Delhi, India-France Technology Summit 2013  
Email : [info@indiafrancesummit.org](mailto:info@indiafrancesummit.org)
- November 15-19, 2013 Madurai/Kodaikanal, India Scientific Council meeting of CEFIPRA  
E-mail : [director@cefipra.org](mailto:director@cefipra.org)
- November 20-21, 2013, Madurai, India Industrial Research Committee meeting of CEFIPRA  
E-mail : [director@cefipra.org](mailto:director@cefipra.org)

**INDIA-EU JOINT HOUSE FOR SCIENCE & INNOVATION**  
6-7 June 2013 | New Delhi

Collaboration of European Member States & associated countries with India over the last decade has pointed towards the need for a single window mechanism for processing collaborative projects between EU and India. In order to assess the feasibility of such a mechanism, European Commission has commissioned a feasibility study for establishing an INDIA-EU JOINT HOUSE FOR SCIENCE & INNOVATION (INDIA SI HOUSE). A consortium of nine institutions from India and EU Member States has been formed for this purpose. Being one of the partners, CEFIPRA has been entrusted the responsibility of recommending a legal framework and suggest scientific priorities as a part of this study.

In the course of the feasibility study a meeting of the Executive Committee, involving a workshop with

Executive Advisory Board (EAB), was held at New Delhi on 5-7 June 2013. The workshop with EAB members, conducted on 6 June 2013, was an opportunity for all project partners to present the preliminary results of their efforts under the project.

CEFIPRA also presented its initial results and findings pertaining to legal framework and scientific priorities. EAB members evaluated the work of various partners and made several recommendations. This included questions to be examined further in the projects pertaining to Innovation & PPP, Mobility, Budget Analysis, Legal Issues and Intellectual Property Rights. EAB emphasised upon following an open-ended & broad-minded process and out-of-the box thinking to visualise new scenarios and pathways. ●

**TDB MEETS bpiFRANCE**  
9 July 2013 | Paris



Mme. Isabelle Lebo, BPIFrance; Dr. Debapriya Dutta, CEFIPRA; Mr. Alain Renck, BPIFrance; Dr. Jacques Gautray, bpiFrance and Mr. Niraj Kela, TDB

A Memorandum of Understanding (MoU) was signed between Technology Development Board (TDB), India (TDB) and bpiFrance on February 14, 2013 to foster exchanges and innovative collaborations between companies, organizations and institutions of France and India.

As a follow up to the MOU, a joint meeting was held on July 9, 2013 in Paris to work out the modalities of Call for Proposals for Innovation under the trilateral framework of TDB-bpiFrance-CEFIPRA. The call is to be announced during the Technology Summit scheduled at Delhi in October 2013. It has been agreed that the support will be provided to Small and Medium Enterprises (SMEs) from India and France in the sectors of Automotives, Aeronautical Sciences and Biotechnology. ●

**VISIT OF FRENCH SENATORS**  
15 July 2013 | New Delhi



Mme Josette Durrieu | Dr Debapriya Dutta | Mme Kalliopi Ango Ela  
Dr Dominique Aymer | Mme Sophie Primas | Dr. Marine Ridoux

A delegation of French Senators visited India from July 14 to 17, 2013. The members of the delegation were consisted of Mrs. Kalliopi ANGO ELA, Senator for French People abroad; Mrs. Sophie PRIMAS, Senator for Yvelines (Ile-de-France); Mrs. Josette DURRIEU, Senator for Hautes-Pyrénées (Midi- Pyrénées) and Mrs. Aude BORNENS, Counsellor to the Senate.

On July 15, 2013, the delegates interacted with Director, CEFIPRA to know more about CEFIPRA's contributions towards promoting R&D projects in the sectors of Health, Energy and Communication. The Senators appreciated the CEFIPRA's emphasis on Public Private Partnerships mode of support for creating social common goods. ●



# INDIA-FRANCE TECHNOLOGY SUMMIT | 23-24 OCTOBER | 3 NEW-DELHI



The Global Technology Summit & Technology Platform is India's most effective yearly platform for forging techno-business collaborations among industry, institutions and Government departments/ministries in the form of Technology Transfer, Joint Venture, Joint R&D, Joint Projects & Joint marketing of new products and services.

France is the partner country of the Industrial Technology Summit 2013 scheduled on 23 October 2013 at New Delhi.

Technology Summit-2013 seeks to promote technological and trade exchanges between France and India and is an opportunity for Indian and French industry, institutions and government to explore technology partnerships in the priority areas.

A large French delegation of French industry and research institutions led by Mrs. Geneviève FIORASO, Minister of Higher Education and Research, Government of the French Republic will

participate at the India-France Technology Summit and Technology Platform, jointly organized by the Confederation of Indian Industry and the Department of Science & Technology, Government of India.

This year's summit with France will facilitate technology partnerships in the following focus sectors:

- Chemical & Materials
- Aeronautics & Aerospace
- Biotechnology, Agri-Food & Healthcare
- Smart Cities, Energy & Climate

ICT is a transversal domain, therefore, it will be included in each sector.

This is a great opportunity for Indian industry, institutions and government to explore technology partnerships with French industry and institutions in the focus areas. ●

## ORGANIZERS



## INDUSTRIAL RESEARCH PROGRAM

### Special Call for Proposals in the field (s) of Automotive and Aerospace Engineering

Industrial Research Program of CEFIPRA is designed to support collaborative research projects involving academic and industrial partners. The objective is to promote the development of new processes or products or the improvement of existing processes and products, thus offering industrial partners an enhanced competitiveness at the international level.

Concept Notes (2-3 pages) invited from Automotive and Aerospace sector industrial organisations (including ancillaries) for examination by Industrial Research Committee of CEFIPRA, comprising of experts from India and France. Shortlisted applicants will be asked to submit detailed proposals subsequently. *For detailed terms and conditions visit [www.cefipra.org](http://www.cefipra.org)*

*For further information please contact:*

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Director, Indo-French Centre for the Promotion of Advanced Research (CEFIPRA)

Email: [director@cefipra.org](mailto:director@cefipra.org) Website: [www.cefipra.org](http://www.cefipra.org)

Last date for the receipt of applications | **30 September 2013**



Indo-French Centre for the Promotion of Advanced Research (IFCPAR) is a model for international collaborative research in advanced areas of science and technology. The centre was established in 1987 with support from Department of Science & Technology, Government of India and the Ministry of Foreign Affairs, Government of France.



For further information please contact:

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