

# ENSEMBLE

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



## CEFIPRA Contributing to the Global Common Goods



# editor's note

Joseph E. Stiglitz in his book in 1919 proposed knowledge as one of the greatest global public goods, by definition which is non-rivalrous and non-excludable. In this edition, we are presenting examples of CEFIPRA's contributions in generating the global common goods in the sectors of Health and Water. These successful Indo-French knowledge pursuits found the inhibition pathway of the growth of *Plasmodium falciparum* in erythrocytes and identified a novel drug target against Malaria and also developed a continuous flow electro-coagulation process for removal of nitrate from water. The utility of this knowledge is not limited within the geographic boundary of the two nations, but for the entire humanity. We are delighted to share the view of our new French Co-Chair, Mme. Anne Grillo on Indo-French S&T cooperation and its benefits to both the societies. In the exclusive feedback articles, the Raman-Charpak fellows of 2013 have shared their experience, which will definitely strengthen the supply chain of the Indo-French knowledge cooperation.

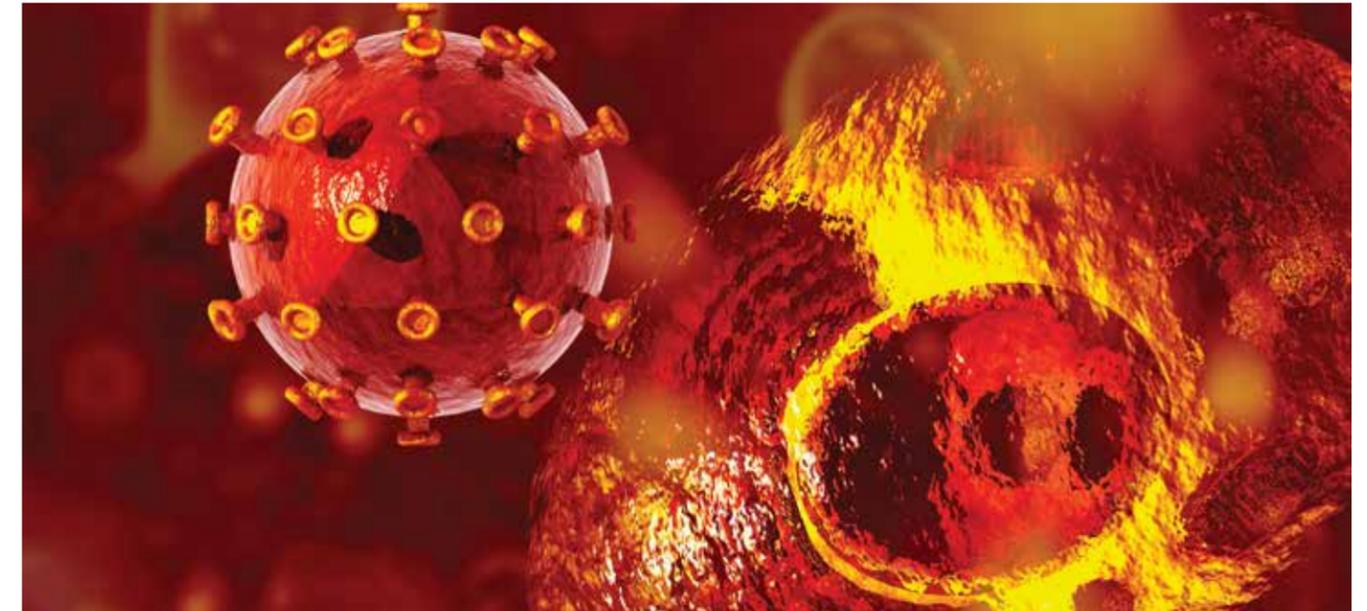


Debapriya Dutta  
Director, CEFIPRA

We thank the members of the Scientific Council and Industrial Research Committee for helping us in selecting the right partners for furthering the Indo-French knowledge innovation chain. During this period CEFIPRA has enriched the bilateral S&T eco-system by supporting the mobility of 22 scientists and 8 students from both the nations. It also organised a meeting between INSERM and DBT for developing a network program on Metabolic Diseases, signed an MoU with L'Association National de la Recherche et de la Technologie (ANRT) for taking the advantage of the program of Conventions Industrielles de Formation par la Recherche (CIFRE) by making it available for the Indian students. During our outreach program on 22 May 2014 in University of Rennes, we could reach out to many new stakeholders whom we expect to be the part of the CEFIPRA's family soon.

We thank many of you for sharing your feedback and hope to hear from more of you. Your feedback is valuable for us.

**I wish you a Happy Summer!**  
**Je vous souhaite un bon été!**



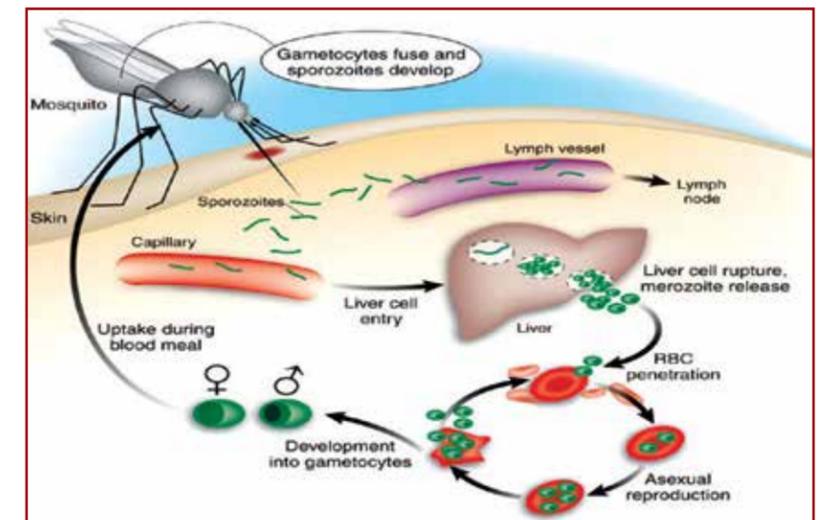
## Understanding Malaria

# Blunting the bite

Malaria is one of the major causes of mortality and morbidity worldwide, affecting nearly 40% of the world's population and accounting for about 3-5 million deaths and more than 500 million new cases annually. Wide spread resistance of the parasite to common and easily accessible drugs like chloroquine and insecticide resistance in the mosquito vector has made the malaria situation very alarming.

Red blood cells (erythrocytes) are the most common type of blood cells and principal means of delivering oxygen to the body tissues via the blood flow through the circulatory system. Malaria survives by invading erythrocytes then replicating within them several times only to burst out destroying the erythrocyte in the process.

To survive and replicate in the red blood cell, the parasite exports proteins that interact with and dramatically modify the properties of the host red blood cell. As part of this process, the parasite appears to establish a system within the red blood cell cytosol that allows the correct trafficking of parasite proteins to their final cellular destinations.



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**MALARIA : AN UNCONQUERED FRONTIER**

Malaria continues to be a major threat to mankind causing over two million deaths worldwide every year. The disease is caused by a protozoan parasite of the genus *Plasmodium*. The most severe form of malaria in humans is caused by *Plasmodium falciparum*. The parasite requires two different hosts for its productive life cycle. The sexual cycle of the parasite takes place in the mosquito vector of the genus *Anopheles* and the asexual cycle takes place in humans.

The parasite enters the human body during blood meal by an infected mosquito and first establishes itself in the liver. Following multiplication in the liver, merozoites are released into the blood stream, which invade the erythrocytes for their asexual multiplication. The parasite progresses through ring and trophozoite forms to undergo nuclear division resulting in the formation of schizonts and release of merozoites from the erythrocytes.

The newly released merozoites can either reinvade fresh erythrocytes or undergo gametogenesis to form male and the female gametes. Entry of gametes into the mosquito through a blood meal triggers zygote formation and initiates the sexual cycle.

Despite several years of research by large number of scientists all over the world there is no effective vaccine available to prevent this dreaded disease.

There is an intense interest in developing anti-malarial drugs capable of interfering with parasite growth. While currently there are numerous drugs available for the treatment of malaria, there are resistant forms reported against each one of the drugs available in the market. The emphasis on the continued search for new anti-malarial drugs and novel drug targets in the parasite is therefore greater than ever.

**THE PROJECT**

The project entitled “Protein trafficking in *Plasmodium falciparum* infected erythrocyte” was funded for three years from July 2001 to June 2004. It was a collaborative research grant shared by Dr. Denise Mattei at Institut Pasteur (France) and Dr. Utpal Tatu at the Indian Institute of Science (India). The overall objective of the project was to understand how the malarial parasite adapts in its host environment, how does it tolerate the temperature stress encountered in the host and how are virulent adhesive structures called knobs developed on the infected erythrocyte surface. The French collaborator performed research associated with mechanisms of trafficking of knob components (PfEMP1, PfHRP1 and CLAG9). The Indian collaborator focused on the family of parasite heat shock proteins and described their roles in regulating parasite growth and mediating host cell remodeling events.

**TECHNICAL APPROACH**

The parasite is exposed to wide temperature fluctuations during its life cycle, ranging from 25°C in the mosquito vector, 37°C in humans to 41°C during febrile episodes in the patient. How does the parasite cope with such temperature

fluctuations? My laboratory has been examining the role of heat shock proteins to understand parasite adaptation to changes in environmental temperatures.

CEFIPRA was one of the first agencies to realize the importance of our research and readily supported a joint project between Dr. Denise Mattei of Pasteur Institut and myself. Being a new comer in the field, this support from CEFIPRA was crucial for me to establish my lab in India. Dr. Mattei supported with her years of experience in malaria research.

Using bioinformatic, genomic as well as proteomic tools we have performed a systematic analysis of heat shock proteins coded by the parasite. Our major focus has been on heat shock proteins, namely PfHsp40, PfHsp70 and PfHsp90. Through analysis of their expression, localization, abundance and complexes we have addressed their functions in parasite growth and development.

In addition, we have used pharmacological agents capable of binding and interfering with Hsp90 to address the role of PfHsp90 in parasite growth in human erythrocytes. Using geldanamycin (GA), a specific inhibitor of Hsp90 function



we have shown that PfHsp90 function is essential for survival of the parasite in human erythrocytes. Exposure to GA potently inhibits the growth of *Plasmodium falciparum* in erythrocytes. In addition to implicating GA as an anti-malarial drug our results indicate PfHsp90 to be a novel drug target against malaria. Further studies on the inhibitory effects of GA in terms of its binding to PfHsp90, its IC50 values, its specificity as well as validity in an animal model of malaria have been examined. More recently, we have extrapolated these findings to other protozoan infections such as amoebiasis, giardiasis as well as trypanosomiasis and babesiosis in animals. Our studies point to a critical role played by Hsp90 in these infectious disease causing organisms.

**OUTCOMES/WAY FORWARD**

We have a patent (PCT/IN2003/000374) to secure a priority on our discovery of PfHsp90 as a drug target against malaria. The patent includes a novel high throughput assay to screen for new compounds, acting through PfHsp90, to arrest the

growth of malarial parasite in human erythrocytes.

Several research groups all over the world are now following upon this observation and a search for optimal inhibition is being pursued.

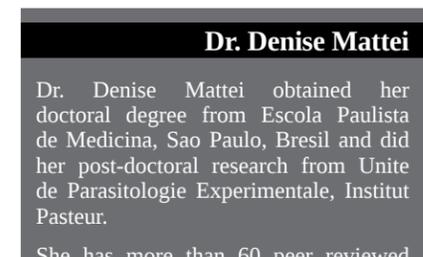
**APPLICATION**

Is GA just another inhibitor or a promising anti-malarial drug? It turns out that even before we showed anti-malarial properties of GA, it was proposed as an anticancer drug. A GA derivative is currently in clinical trials to be used in the treatment of cancer. Consequently a large amount of information, relevant for the use of GA as a drug in humans is already available. Design of its derivatives, toxicity studies in animals as well as bioequivalence studies have already been performed. Indeed the compound has met all the requirements to be tried in humans. This means that the normally long and convoluted path, from discovery of a compound to its realization as a drug, is significantly cut-short for GA as an anti-malarial. ❤️



**Dr. Utpal Tatu**

Dr. Utpal S. Tatu obtained his Ph.D. from Indian Institute of Science. As a Professor in the Department of Biochemistry at the Indian Institute of Science his research aims to develop cheaper and more effective treatments for neglected diseases such as malaria. Prof. Tatu has over 50 peer reviewed international publications and holds two international patents.



**Dr. Denise Mattei**

Dr. Denise Mattei obtained her doctoral degree from Escola Paulista de Medicina, Sao Paulo, Bresil and did her post-doctoral research from Unite de Parasitologie Experimentale, Institut Pasteur.

She has more than 60 peer reviewed publications and received Jacques Monod de la Fondation de France Award during 1985.

leader



### Removing Nitrates from potable water

## Safe Water, Secure Lives

Nitrate contamination of potable water sources is becoming one of the most important water quality concerns. The major health concern of nitrate exposure through drinking water is the risk of methemoglobinemia, or “blue baby syndrome”, especially in infants and pregnant women. Nitrate is naturally occurring at low levels in most waters, but it is particularly prevalent in groundwater that has been impacted by certain agricultural, commercial, or industrial activities.

#### THE PROJECT

The objective of the project was to remove nitrate from water to nitrogen without any undesirable intermediates. Two routes were compared: the catalytic and the electrocatalytic ones. For that purpose, palladium/tin catalysts were prepared and characterized by various surface analytical techniques in order to have a clear

structure/activity relation. The activity and selectivity for nitrate removal was determined by catalysis and electrocatalysis. The catalytic reduction of nitrate in water was evaluated by varying different parameters (pH, hydrogen partial pressure and the temperature). The electrocatalytic reduction of nitrate in water was examined by fast sweep cyclic voltammetry, square wave

leader

### WATER – A CONTINUING MYSTERY

We all know that we must drink water every day, so no explanation is needed for the fact that we need water to stay alive. But, water crisis has become a part of our life. This is not altogether due to shortage of rainfall. Increasing population, growing industrialization, expanding urbanization, agriculture etc. demand more and more water. Coping up with these developments requires various tactics to overcome the water shortage and satisfy the need of all. According to World Health Organization (WHO), more than 900 million people in the world do not have access to potable water. Water contamination causes death to around 3.3 million people and in that 1.8 million children from diarrhoea every year. Water scarcity can also affect ecosystem as numerous species might not be able to cope with decrease in availability of freshwater. The development of sustainable, robust and energy

efficient water purification technology is one of the greatest challenges in this century. Ground water is often contaminated with nitrates especially in areas of intense agricultural activity as a consequence of leaching of highly soluble nitrogen-based fertilizers. Nitrate and its metabolites, particularly nitrite formed on reduction of nitrate, are toxic for the human body, and are especially harmful in infants. Nitrates combine with haemoglobin forming methaemoglobin that causes Blue Baby Syndrome, and nitrosamine formation can cause hypertension and cancer. In recognizing the importance of controlling exposure to excess nitrate in drinking water, the World Health Organization (WHO) introduced a recommended maximum concentration of nitrate at 10 mg/L. The EU has suggested levels of 50, 0.1 and 0.5 mg/L for  $\text{NO}_3^-$ ,  $\text{NO}_2^-$  and  $\text{NH}_4^+$  respectively.

voltammetry, amperometry, rotating ring disc electrode and steady state polarisation techniques. Finally catalytic and electrocatalytic processes were compared in the identical conditions.

#### TECHNICAL APPROACH

The bimetallic Pd-Sn entities were prepared both by electrochemical and classical chemical techniques. Particularly, the size of tiny nano particles deposited



Group Photo (Ms. J. Lakshmi, Dr. S. Vasudevan, Ms. D. Abirami and Dr. Florence Epron)

on palladium was controlled as much as possible in order to make the comparison between catalysts and electrocatalysts possible. The parent palladium catalyst was either modified by electro-deposition of palladium or large particles of palladium on a support. Pd-Sn/Ti and Pd-Sn/Cu electrodes were prepared by depositing Pd in a substrate and then impregnating various amount of Sn on it. Classical bimetallic catalysts supported on alumina or graphite was prepared in two-steps. In a first step the parent monometallic catalyst was prepared by simple impregnation of a precursor salt on the support and then activation by calcination and reduction. The second step consists of the deposition of the second metal by a method named “catalytic reduction”.

Initially, all the electrodes were subjected to physical characterization to gain information on the distribution of metals especially tin on the surface of the noble metal particles, on the presence or absence of alloys or solid solutions, on size of the particle. Later, the supported catalysts were evaluated in catalytic reduction using hydrogen as reducing agent. Their catalytic performances (activity and selectivity) were evaluated by varying different parameters (pH, hydrogen partial pressure, and temperature). The kinetic and mechanism of electrocatalytic reduction of nitrate were examined using methods such as fast sweep cyclic voltammetry, square wave voltammetry, amperometry and rotating ring disc electrode as well as steady state polarization technique. Finally as a scale up study, the experiments were conducted in a continuous reactor for nitrate removal.

**OUTCOMES/WAY FORWARD**

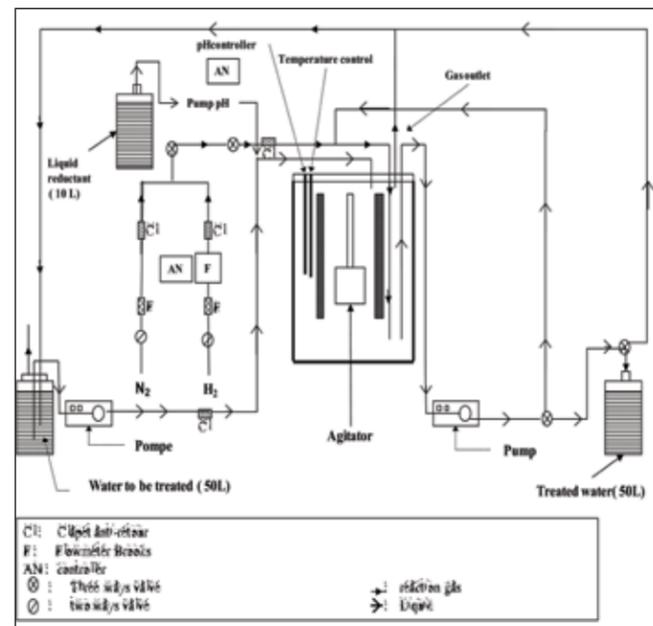
An undivided electrochemical cell was operated using Pd/Ti, Pt/Ti, PdSn/Ti, PdIn/Ti, PdAu/Ti and PdAg/Ti as cathodes and metal oxide coated titanium as anode for removal of nitrate from water. It is achieved that the nitrate was removed completely using PdSn/Ti and PdAg/Ti as cathodes and metal oxide coated anode. A prototype portable Electrochemical Nitrate Removal Unit was developed (Photo 1) and this unit will remove the nitrate from 1000 mg/L to less than 40 mg/L.

The selective chemical reduction of nitrate in water was carried out at semi-batch level using Pd-X bimetallic catalysts (X = Sn, In and Ag), prepared by surface controlled reaction method on various supports (Al<sub>2</sub>O<sub>3</sub>,



Photo 1 : Continuous electrochemical flow reactor (India)

SiO<sub>2</sub>, TiO<sub>2</sub>, Graphite, Carbon, Activated Carbon, CeO<sub>2</sub>, CexZr1-xO<sub>2</sub> and ZrO<sub>2</sub>). The best catalyst in term of activity was Pd-Sn supported on alumina, with 5wt.% of Pd and a Pd:Sn ratio of 4:1. Nitrate reduction leads to the formation of molecular nitrogen in majority and some ammonium ions. When carried out under hydrogen as reductant, the reaction leads also to the formation of hydroxide ions and thus to an increase of the pH level. The control of pH is effectively done by passing CO<sub>2</sub> along with H<sub>2</sub> and the optimum ratio for the mixed flow of H<sub>2</sub>:CO<sub>2</sub> was found to be 80:20 for the total flow of



Scheme 1: Pilot reactor to treat continuously raw water (France)

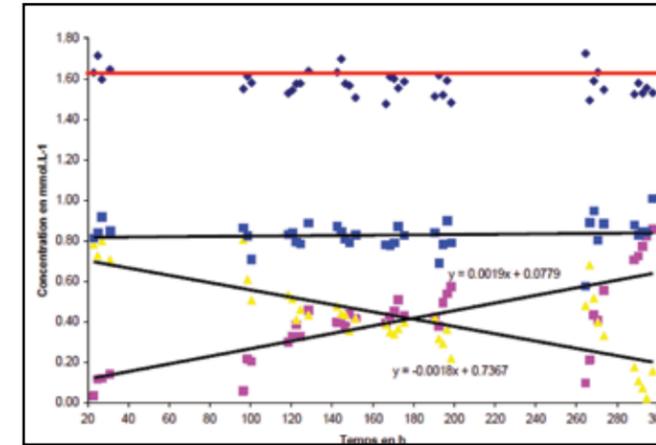


Figure 1: Nitrate removal in a continuous reactor during 300h

250ml/min. The suitable temperature was observed to be 25°C. The experiments were carried out on a pilot reactor (Scheme 1), in a continuous flow using real waste water. It was shown that 100% of nitrate was converted after 20h of treatment (Figure 1).

A continuous flow electrocoagulation process (Photo 2) was developed for the removal of nitrate from water at



Photo 2 : Electrocoagulation Process

an acceptable level of nitrate, nitrite and ammonia. The results showed that the optimum removal efficiency was achieved at an optimum current density of 0.25 A/dm<sup>2</sup> and pH of 7.0 using aluminium as anode and cathode. The removal efficiency of 97% was achieved. ❤️

**IN A NUTSHELL**

- Highest active and selective catalysts PdSn αAl<sub>2</sub>O<sub>3</sub> and PdSnTiO<sub>2</sub> to N<sub>2</sub> prepared
- Superior nano electrocatalysts PdSn/Ti and PdAg/Ti developed for direct electrochemical reduction of NO<sub>3</sub><sup>-</sup> to N<sub>2</sub>
- Developed a 25A (1.5L/hr) capacity electrochemical nitrate removal unit to treat maximum of 1000 ppm nitrate
- An electrocoagulation process (0.5L/hr) developed for nitrate removal without intermediates



**Dr. S. Vasudevan**

obtained his Ph.D from Alagappa University in 1995. He joined Central Electrochemical Research Institute, Karaikudi in 1997 and currently serves as a Principal Scientist. He has been working in diverse areas of electrochemistry for the past 20 years. He has published more than 85 research papers in reputed peer reviewed journals and written six book chapters. He is serving as associate editor and editorial board member for different international journals. As an outcome of his innovative research, he has been granted with eight Indian patents and one international patent. He has transferred five technologies to different industries. He has been conferred the "International Best Researcher" award by the International Science Congress Association in 2012 and "Eminent Scientist Award" by Indian Society for ElectroAnalytical Chemistry in 2013.



**Dr. Florence Epron**

obtained her PhD degree in 1991 from the University Pierre and Marie Curie (Paris 6, France) in 1991. After a post-doc at the University of Poitiers at the Laboratory of Catalysis in Organic Chemistry (LACCO), she joined the CNRS (National Center for Scientific Research) in 1994 as Researcher in the same Laboratory, merged in 2012 with 3 others to constitute the Poitiers Institute of Chemistry: Materials and Natural Resources. She has been working in Heterogeneous Catalysis for more than 20 years. Her research primarily focused on the areas of water treatment by catalytic oxidation or reduction, and then was extended to catalysis for energy (reforming, hydrogen production and purification...). She has published more than 60 peer-reviewed papers referenced in the ISI web of knowledge (h index 18) and 4 book chapters. She has 8 International and French patents.



Mme. Anne Grillo  
Co-Chairperson  
Governing Body CEFIPRA

Born in Marseille, France, Mme. Anne Grillo has a distinguished career to be proud of. She has served Government of France in several important positions within France as well as in diplomatic positions across the world. Her overseas assignments include being the First Secretary, and later Deputy Counsellor, at Embassy of France in China (1993-1999). She has also served as Minister Counsellor, Embassy of France in Morocco (2006-2010) and Consul General of France at Barcelona, Spain (2010-2013). Mme. Anne Grillo was recently on her first visit to India in her capacity as co-chairperson of CEFIPRA's Governing Body. She spoke to ENSEMBLE about her vision for S&T cooperation between India and France.

**ENSEMBLE :** India and France share a history of engagement spanning over six decades. In what manner you may suggest the S&T cooperation between the two nations can be enhanced through diplomatic efforts?

**Mme. Anne Grillo (AG):** India and France are two democratic countries where scientific traditions are strong. Nowadays, India is a major emerging power, France is an influential power on the global stage and a key player within the European Union. We have common interests in sharing knowledge and fostering Indo-French relationship through science and technology. Science diplomacy encapsulates great challenges and opportunities, at the cross road of soft power (“Diplomatie d’influence”) and economic diplomacy (“Diplomatie économique”).

With India, our diplomatic effort is aimed at sustaining the best conditions for researchers to establish, over the long term, networks and partnerships, geared to furthering development, and supporting the competitiveness of our industries.

This is true at the bilateral level but also regarding our global commitments. The French Government has set itself the objective of strengthening its commitment to take up the global challenges relating to global public goods. For instance, France is organizing the next Conference of the Parties to the United Nations Framework Convention on Climate Change in 2015 in Paris (COP21). The contribution from the scientific communities is one of the essential components to the success of the Conference, and it would be great to see Indian and French scientists join forces to meet these ambitions.

**ENSEMBLE :** You have taken over as Co-Chair of CEFIPRA, when its mandate is expanding across knowledge innovation chain. In your opinion, what should be the future partnerships of CEFIPRA?

**AG :** The redefinition of the mandate given to CEFIPRA in 2012, prompted by the French ministry of Foreign Affairs and International Development and the Indian Department of Science and Technology, has marked a positive step forward. Lots of efforts were put since, to bring in under CEFIPRA’s umbrella other public agencies and also companies wishing to contribute to research and development. A more recent initiative targets clusters with a strong regional base. Such regional twinning is very interesting because it seeks interrelated advantages, across the continuum of higher education, public research and industrial R&D.

In my view, CEFIPRA has a role to play to help match the right partners in France and in India, and give them time to mature a balanced and sustainable partnership. What should be our common goal? Build stronger economies, with well-trained and innovation-minded people.

**ENSEMBLE :** France is deeply into research and development in the advanced areas of S&T which is of great importance to India. How can India and France maximize the benefits from the alignment of interests in S&T, with particular emphasis of industry?

**AG :** There are numerous opportunities in a diversity of sectors such as sustainable cities, transport, energy, communication systems, biotechnologies, etc. At the institutional level, our role is to build on the joint initiatives of the top French and Indian research institutions, and to foster partnerships with the industry. Big corporations like Saint Gobain, DCNS, Airbus, Alstom, Danone, Limagrain, L’Oréal have established R&D centers in India, most of them in partnership with Indian and French higher education and research institutes. We also need to help bring in SMEs to benefit from such public-private collaborations.

**ENSEMBLE :** The rich cultural exchange between the two nations has expanded over time and is flourishing. How could we take advantage of these links to use S&T for societal benefits for both the countries?

**AG :** The health sector is a good example : the scientific quality of the research developed by French

public institutions, such as Inserm, Institut Pasteur and IRD, is recognized internationally. Their know-how spans from fundamental science, translational research, to technological transfer towards the pharmaceutical or biotech industry. Collaborations with Indian researchers have increased in the recent years, with the creation of joint laboratories (on Nervous system therapies, Immunopathology, Genetics of infectious diseases, and liver diseases), and also thanks to calls for bilateral research proposals financed by the French and the Indian governments. Such collaborative research has a tremendous impact on public health policies. The ultimate goal is the well-being of populations.

**ENSEMBLE :** Your connection with India is old. After your recent visit, what is your views of changing India and what is your message for CEFIPRA?

**AG :** I recently visited India on the occasion of the CEFIPRA Governing Body in March 2014. I could witness the changes in New Delhi. There are great traditions of intellectual debate both in Indian and in French societies. We value science, technology but also our cultural heritage. CEFIPRA should build on such shared grounds to continue to nurture Indo-French collaborative projects. Science progresses where there are solid fundamentals. We have to offer opportunities for young scientists, both in France and in India, to get the best training, by fostering cross-generation and multi-cultural sharing of knowledge, with an open-mind. ♥



Mme. Anne Grillo with Dr. Debapriya Dutta Director CEFIPRA during her visit to India

Raman-Charpak Fellowship

# Building New Bridges

The Raman Charpak Fellowship Program is named after two Nobel Laureates in Physics, Prof. C.V. Raman, 1930 Indian Nobel Laureate, and Prof. Georges Charpak, 1992 French Nobel Laureate. The aim is to facilitate the exchange of doctoral students between the two countries for exposing them to the ST&I environment of the partnering country. We asked some of the recent Raman Charpak fellows to share their experiences with us. Excerpts:

I am a PhD student under the supervision of Prof. Françoise Combes at LERMA, Observatoire de Paris, France. The Raman-Charpak fellowship gave me the opportunity to work with Prof. Chanda Jog at the Indian Institute of Science (IISc), Bangalore, India, from 10 January to 11 April 2014.

During my stay in India, I could interact with the IISc astrophysics research team, notably through weekly meetings, and also to visit the Inter-University Center for Astronomy and Astrophysics (IUCAA) in Pune. This enabled me to attend a workshop entitled "Radio studies of galaxies and galaxy systems", to give a talk, and to interact with other researchers in the field.

During my visit, we were able to pursue the work we had started earlier on gravitational instabilities within filaments, to apply our results to a fiducial interstellar filament, and to obtain more general calculations. The following publications benefited from this fellowship:

- Freundlich, J., Jog, C. J., & Combes, F., 2014, Local stability of a gravitating filament: a dispersion relation, *A&A*, 564A, 7F
- Ananthpindika, S., Freundlich, J., & Jog, C., 2014, On the formation of filamentary clouds via non-isothermal collapse, submitted to *MNRAS*



**Jonathan Anthony Freundlich**  
LERMA, Observatoire de Paris, France



**Shubhra Singh**  
IFTM University,  
Lodhipur Rajput  
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Uttar Pradesh

It was a wonderful experience to spend time with peers in France as a Raman Charpak Fellow. I found the experience extremely enriching, academically as well as personally. My Ph.D. was focused on tuberculosis. I was delighted at the fact that Raman Charpak Fellowship will allow me to work with the group headed by Dr. Laurent Kremer at University of Montpellier II, France which was already working on tuberculosis. I worked on new strains of Mycobacterium in France on which I had never worked before and that species is a big threat to the western countries and I also learned new skill about planning experiments.

Courtesy the exposure under the Raman Charpak Fellowship I not only have a good handle on the Zebra fish model, I have submitted two research papers as co-author. Fellowships like the Raman Charpak Fellowship open new gates for collaborative research by allowing researchers work together and develop the professional affinity which is needed for long term professional relationships.

My sincere gratitude to Dr. Vinita Chaturvedi and Dr. Laurent Kremer (My French Host) for their encouragement and to CEFIPRA for supporting me. I look forward to further develop new linkages with my peers in France.



**Esther Dalko**  
PhD student at CIIL / CNRS  
8204 / INSERM U1018 /  
Institut Pasteur de Lille/  
PRES Lille Nord de France  
(Université Lille 1), Lille,  
France and at Université du  
Québec à Montréal, Montréal,  
Canada

As a PhD student, in a joint program between the Université Lille 1 – France and Université du Québec à Montréal – Canada, I am studying the effects of heme on the response of immune cells, and its impact on the outcome of severe malaria. Over the past years, our French team has established strong collaborations with Indian laboratories leading to launch of the International Laboratory in Systems Immunology and Genetics of Infectious diseases (LIA SIGID) in 2012. In this context, collaborative studies on the immune response in human malaria are being conducted in cooperation with the Tata Institute of Fundamental Research, Mumbai, India, the Institute of Life Sciences, Bhubaneswar, India, the Ipat General Hospital, Rourkela, India, and the SCB Medical College, Cuttack, India.

The Raman-Charpak fellowship gave me a chance to work beyond mouse models and to correlate plasmatic heme levels with the immune response and with malaria severity from patients living in Odisha. Our results clearly indicate a role of heme in the pathophysiology of cerebral malaria and malaria associated acute renal failure. While in India I also got an opportunity to meet our collaborators and to establish strong contacts with them and with their students for further collaborative works. It was also the occasion to meet and share my medical experience with Medical Doctors and patients and to feel the direct impact of our research. Having the opportunity to spend time in Mumbai and Odisha was an amazing experience to discover the richness of the Indian culture.



**Sneha C. Sagarkar**  
RCM Nagpur University

Pesticides and herbicides are major component of agricultural industry. Removal of these pollutants from the environment is crucial and hence bioremediation is a priority area of research. In the ecosystem, natural restoration by adaptation of soil microbial communities leads to evolution of proteins with efficient degradation potential.

biodegradation especially pesticide biodegradation.

The regular communication with CEFIPRA staff and my French collaborators helped me a lot to plan my visit to INRA, Dijon, a very well equipped lab to study soil sciences. People in F Martin- Laurent group were also very cordial and helpful in work. Dr. Martin-Laurent guided me in work at INRA.

While at INRA I was able to characterize multiple pesticide degradation, mineralization and genomic localization of atrazine degrading traits of bacteria isolated from Indian agricultural soils. Characterization of these bacteria at INRA provided a platform to design bioremediation process and efficient monitoring strategies which will be helpful in taking lab scale bioremediation programs for field trials.

Raman- Charpak fellowship provided me an opportunity to work with F Martin- Laurent group, which is a leading research group aiming at understanding the mechanism responsible for adaptation of soil microflora to pollutant



**Dharmendra Tomar**  
Ph.D. Student at Indian  
Institute of Advanced  
Research (Pune University),  
Gandhinagar, Gujarat

I am a researcher working in the area of cell death and survival. Raman-Charpak Fellowship gave me an opportunity to work in well renowned French laboratory actively working in the area of mitochondrial biology. Here, in France with Dr. Benard Giovanni group in MRGM, University of Bordeaux, I have gained good research experience in the area of mitochondrial biology. This fellowship gave me an opportunity to not only learn new things

but also opened windows for building long term collaboration with Dr. Giovanni's group as well as discussing our findings and potential collaborations with peers in this field. Our studies generated interesting findings and helped in generating ideas for future work.

Raman-Charpak fellowship also provided an opportunity to closely feel the vibrancy of French culture and Bordeaux is best place for the same.

## feedback/report



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Laboratory  
Pune-411008

I was very excited when I saw the results of Raman-Charpak Fellowship 2013 as this was to be my first international fellowship and a chance to work at Universite de Poitiers under the guidance of Prof. Nicolas Alonso-Vante. His attitude towards students, active discussion with them and work culture was indeed exemplary and memorable. He polished my perspectives and knowledge about my research area. I was able to interact with highly motivated international students in his lab with huge enthusiasm and spirit.

Poitiers is a small, calm and quite city in Southern France with very helpful and kind hearted people. Even though the number of Indian citizens in Poitiers is small we managed to communicate with each other and arranged regular get-togethers. I am very thankful to

Mr Shashikanth Bhosle for his support and encouragement during my stay at Poitiers.

Prof. Nicolau Alonso-Vante was kind enough to provide me a valuable opportunity to participate in an international conference organized by European Material Research Society held at Lille. It provided a platform for active interaction with many eminent scientists from all over the world related to my active research area. In short, CEFIPRA has provided an opportunity to explore various dimensions of my research interest in a foreign university with amicable work culture. Henceforth, I encourage all my colleagues and friends to utilize this unique and invaluable opportunity provided by CEFIPRA to sharpen and enhance their research skills.

## report

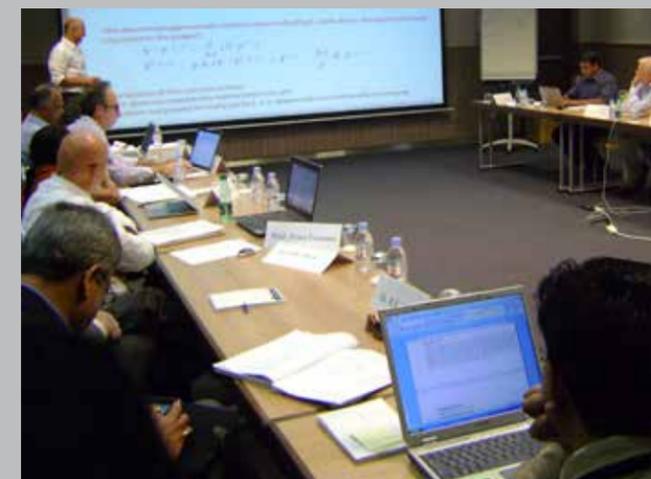
### Scientific Council and Industrial Research Committee Meeting

May 19-22, 2014  
Dinard, Bretagne

Fifty-third meeting of the Scientific Council and twenty fourth meeting of the Industrial Research Committee of CEFIPRA were held during May 19-22, 2014, at Dinard, Bretagne, France. During the meetings project proposals received from researchers from different S&T domains were discussed and recommended for appropriate funding decisions based on scientific merit. Proposals received for holding seminars were also discussed during the meetings.

Considering the fact that the number of proposals received under the domains of Mathematics, Computer Science, Earth & Planetary Science and Environmental Sciences are less, members of the Scientific Council recommended holding of seminars in these particular areas for enhancing formulation of new proposals.

To achieve the objective of reducing the lead time from proposal submission to evaluation and grant release, if applicable, the Scientific Council has recommended the launch of the web-based proposal submission system at CEFIPRA which is expected to be in place from next cycle of proposal submission.



During the meeting of Industrial Research Committee, the PPP program of CEFIPRA, where a theme based industrial research activity is jointly supported by Industry (or a consortium of industries) and CEFIPRA, leading to technological development in a specific theme was also discussed. ●

### Indo-French Seminar on Next Generation Network

April 5, 2014  
New Delhi

Science & Technology Department, Embassy of France in India and Computer Society of India in association with CEFIPRA organized a Seminar on "Next Generation Networks" at India Habitat Centre, New Delhi on 5<sup>th</sup> April, 2014. It was addressed by eminent delegates from France and India. The objective of the seminar was to discuss on the emerging developments in the field of Networks in view of emerging enterprise IT landscape comprising of cloud services, mobility, social media usage and Big Data analytics. The Seminar aimed at bringing awareness about NGN technologies and applications among various stakeholders, especially the policy makers, regulators and academicians.

The program was divided into five technical sessions based on the following five themes:

- NGN Architecture and Technological Trends and Issues in NGN
- Quantum Communication: Issues, Myth or Reality
- Optical Fiber – Challenges for New Generation Communication Media
- Wireless and Service Control
- Digital Services and Applications of Tomorrow through NGNs ●



### Outreach Program at University of Rennes

May 22, 2014  
Rennes

CEFIPRA organised an Outreach Program in University of Rennes on May 22, 2014 as an effort to reach out to the French Scientific Community. Faculty members and students from various diverse S&T departments of University of Rennes participated in the program. Prof. Pierre Van de Weghe, Vice President International Relations, Université de Rennes welcomed the delegation that also included members of the Scientific Council of CEFIPRA.

Director CEFIPRA explained the role of CEFIPRA as an institution dedicated to catalysing the Indo-French collaboration in Science & Technology over last 25 years and its various mechanisms to achieve its objectives. Diverse perspectives on Science & Technology cooperation between India and France were presented by various representatives from the Indian Ministry of Science & Technology and the French Embassy in India. As a part of the program, Dr. Ayyapan Pillai Ajayaghosh, Member, Scientific Council delivered a Lecture on "Fluorescent Supramolecular Architectures" and Prof. Gerard Huet, another member gave a lecture on Indo-French S&T cooperation highlighting the great works of Mathematicians of both the countries.



Director, CEFIPRA and Members of the Scientific Council responded to the queries of the participants on different programs of CEFIPRA. Posters on scientific outcomes of various CEFIPRA initiatives were also displayed which attracted the attention of a large number of students and scientists during the course of the day. ●

MoU with Association Nationale de la Recherche Technique

May 16, 2014  
Paris

The Association Nationale de la Recherche Technique (ANRT), the French national association for research and technology, represents public and private entities dedicated to research and innovation. The ANRT administers France's system of industrial agreements for training through research, known as Convention Industrielles de Formation par la Recherche (CIFRE). Since 1981, by delegation of the Ministry of Higher Education and Research, ANRT has been in charge of the CIFRE program.

CIFRE is a French doctoral fellowship program where the doctoral students are employed by a French company which cooperates with a public laboratory. This program is accessible to foreign students. Director, CEFIPRA & Délégué general, ANRT has signed a Memorandum of Understanding (MoU) on 16th May, 2014. Through this MoU, CEFIPRA



and ANRT will collaborate for making the CIFRE program available for Indian students. ●

DBT-INSERM meeting at Paris

May 26, 2014  
Paris

Department of Biotechnology (DBT) from India and Institut Nationale de la Santé et de la Médicale (INSERM), France have expressed their desire to join hands to enhance the scientific cooperation between INSERM and DBT through a research network program involving eminent research teams from India and France in the domains of Metabolic diseases. In this connection a preliminary meeting was organised by CEFIPRA on 26th May, 2014 in Paris. The meeting focused on the perspectives of collaboration between INSERM & DBT and the implementation of foreseen

INSERM-DBT targeted network program.

The program aims to increase the visibility of scientific research from both sides and to develop collaboration through the exchange of researchers and students, organising workshops and seminars etc in the targeted areas of mutual interest. Some of the key thematic areas identified on preliminary basis are a)- Gene Interaction (environment interaction & epigenetic) b)- Inflammation and Immunity c) – Toxicity d) - Macrovascular complication. ●



MOBILITY OF SCIENTISTS SUPPORTED UNDER CEFIPRA PROJECTS  
APRIL - MAY 2014

	Project Title	Name & Institute Affiliation	Institute Visited
01	Mechanisms of new Long-Lasting Luminescence Biomarkers	<b>Prof. Didier Gourier</b> Laboratoire de Chimie de la Matière, Chimie ParisTech	Goa University, Taleigao Plateau, Goa
02	Effect of the correlations in the statics and the dynamics of extended systems	<b>Dr. Kirone Mallick</b> CEA Saclay	Raman Research Institute, Bangalore and Tata Institute of Fundamental Research, Mumbai
03	Mechanisms of Lysine acetyltransferase (KAT/HAT) activation by small molecule activators and use thereof in memory	<b>Dr. Anne-Laurence Boutilier</b> Laboratoire d'Imagerie et de Neurosciences Cognitives Strasbourg, France	Transcription and Disease laboratory, Molecular Biology and Genetics Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore
04	Rotating and curved boundary-layer instabilities	<b>Prof. Benoit Pier</b> Laboratoire de mécanique des fluides et d'acoustique, École Centrale de Lyon (CNRS-Université de Lyon), France	TIFR Centre for interdisciplinary Sciences, Tata Institute of Fundamental Research, Hyderabad
05	Computational Studies of Frustrated Quantum Magnets	<b>Dr. Fabien Alet</b> Laboratoire de Physique Théorique IRSAMC, Université Paul Sabatier	Department of Theoretical Physics Tata Institute of Fundamental Research Mumbai
06	Multilingual Word Spotting for Degraded Documents	<b>Dr. Umapada Pal</b> Indian Statistical Institute, Kolkata	Université François Rabelais Tours Polytech Tours, Département Informatique Computer Science lab
07	Multilingual Word Spotting for Degraded Documents	<b>Prof. Bidyut B. Chaudhuri</b> Indian Statistical Institute, Kolkata.	Université François Rabelais Tours Polytech Tours, France
08	Effect of the correlations in the statics and the dynamics of extended systems	<b>Dr. Sanjib Sabhapandit</b> Raman Research Institute ,Bangalore	Laboratoire de Physique Théorique et Modèles, Statistiques Université Paris Sud, Orsay
09	All polymer flexible gas sensors (flexi-sensors)	<b>Dr. D.K. Aswal</b> Bhabha Atomic Research Center Mumbai	Université Paris Diderot, Paris, France
10	Molecular mechanisms of immune evasion by M. tuberculosis	<b>Prof. K. N. Balaji</b> Indian Institute of Science, Bangalore	Institut National de la Santé Et de la Recherche Médicale (INSERM), Centre de Recherche des Cordeliers, Paris, France
11	Influence of the Resorcin(4)arene on the catalytic outcomes	<b>Dr. R. Ramesh Ph. D.</b> School of Chemistry Bharathidasan University Tiruchirappalli.	Universite de Strasbourg, Strasbourg, France
12	Optimal inference in complex and turbulent data	<b>Dr. Dharmendra Singh</b> Indian Institute of Technology Roorkee, Roorkee	Centre de recherches, INRIA Bordeaux Sud-Ouest, France

## MOBILITY OF SCIENTISTS SUPPORTED UNDER CEFIPRA PROJECTS

APRIL - MAY 2014

	Project Title	Name & Institute Affiliation	Institute Visited
13	Approximate Solutions of Linear and Non-Linear Integral Equations with Non-Smooth, Kernels	<b>Prof. Rekha P. Kulkarni</b> Department of Mathematics, Indian Institute of Technology Mumbai	Institut Camille Jordan, Universite de Saint Etienne, France
14	Interfaces in Complex Fluids	<b>Dr. M. K. Sanyal</b> Surface Physics Division Saha Institute of Nuclear Physics Kolkata	Laboratoire Interdisciplinaire sur l'Organisation Nanometrique et Supra moleculaire (LIONS), CEA Saclay France
15	Arithmetic circuits computing polynomials	<b>Dr. Srikanth Srinivasan</b> Indian Institute of Technology, Mumbai	Institut Mathematiques de Jussieu, Paris
16	Anti-factor H autoantibody associated hemolytic uremic syndrome	<b>Dr. Arvind Bagga</b> Division of Pediatric Nephrology All India Institute of Medical Sciences New Delhi	Centre de Recherche des Cordeliers, INSERM ,Paris France
17	Theoretical and Numerical Studies in fluids	<b>Prof. Samriddhi Sankar Ray</b> International Centre for Theoretical Sciences (ICTS-TIFR), Bangalore	Universite Nice Sophia Antipolis, Nice
18	Arithmetic circuits computing polynomials	<b>Prof. Meena Bhaskar Mahajan</b> Institute of Mathematical Science, Chennai	Instituté de Mathématiques de Jussieu, Paris, France
19	Emerging strategies for wireless communication networks	<b>Prof. Anurag kumar</b> Department of ECE, Indian institute of Science, Bangalore	Universtié de l'Avignon and INRA, Sophia Antipolis, France
20	Air Pollution Monitoring "Design and Scientific Validation of an operational protocol allowing real-time and dynamic mapping of particulate pollution using quantitative indicators in the vicinity of intense sources"	<b>Dr. Chandra Venkataraman</b> Department of Chemical Engineering Indian Institute of Technology, Bombay	Leosphere , Orsay
21	Analytic aspect of modular forms	<b>Prof. J Sengupta</b> School of Mathematics Tata Institute of Fundamental Research Mumbai	Universite Paris, Villetaneuse
22	Cometary grains : Observations and Simulation	<b>Prof. Asoke Kumar Sen</b> Department of Physics Assam University Silchar	Laboratoire de physique des Solides Universite Paris-Sud, Orsay

## MOBILITY OF STUDENTS SUPPORTED BY CEFIPRA

APRIL - MAY 2014

Domain	Name & Institute	Institute Visited	
Atmosphere and Earth Sciences	<b>Kabilan Mani</b> BITS Pilani K K Birla Goa Campus, Goa	Laboratoire Microorganismes Genome et Environnement, France	
Electrical Engineering	<b>Karan Nathwani</b> Dept. of Electrical Engineering Indian Institute of Technology, Kanpur	Signal & Image processing Department, Institut Mines-Telecom, Paris, France	
Chemistry	<b>N. Natarajan</b> School of Chemistry Barathidasan University, Tiruchirappalli	UMR 7177 Institut de Chimie Universite de Strasbourg, Strasbourg, France	
Atmospheric Sciences	<b>Krishna Mohan K. S</b> National Institute of Oceanography, Goa	Laoratoire d' Oceanographie Experimentation et Approaches Numeriques, Paris, France	
Computer Science	<b>Raman Sankaran</b> Department of Computer Science & Automation, Indian Institute of Science, Bangalore	Laboratoire d' Informatique de l' Ecole Normale Supérieure, Paris, France	
Life Sciences	<b>Ghania Ramdani</b> Paris Descartes University, France	Department of Physics Indian Institute of Science Bangalore, India	
Physics	<b>Saumyadeep Roy Choudhury</b> Assam University, Silchar	UPMC, LATMOS, Guyancourt, France and Univ. Paris-Sud, LPS, Orsay, France	
Physics	<b>Debarghya Banerjee</b> Indian Institute of Science, Bangalore	Observatoire de la Cote d'Azur, Nice, France	

# STUDENT MOBILITY SUPPORT OPPORTUNITIES

## RAMAN-CHARPAK FELLOWSHIP

The aim is to facilitate the exchange of doctoral students between the two countries for exposing them to the ST & I environment of the partnering country. The fellowship duration is 3-6 months. The Fellowship is jointly funded by the Department of Science & Technology (DST), Government of India and the French Embassy in India, Ministry of Foreign Affairs, France.

Research Areas Supported: Life Sciences, Mathematical & Computational Sciences, Material Sciences, Physical Science, Chemical Science, Atmospheric and Earth Sciences, Engineering Sciences.

## CEFIPRA-ESONN FELLOWSHIP

CEFIPRA has joined hands with Université Joseph Fourier, Grenoble, France for supporting doctoral Indian students per annum to participate in the European School on Nano-sciences and Nanotechnologies (ESONN) in Grenoble, France. This prestigious school affords the opportunity to students from various countries to be trained in niche areas of nanotechnology. The program emphasizes the role of laboratory courses structured to highlight fundamental and technological advances in nanotechnology.

## CEFIPRA'S FELLOWSHIP FOR DOCTORAL STUDENTS

CEFIPRA provides opportunity for doctoral student to work under collaborative & Industrial Research projects of CEFIPRA. Support covers international travel and a consolidated fellowship per month which covers lodging, living expenses & local travel. CEFIPRA does not select students directly for the supported project. The concerned Investigators select their student. However, interested student can directly send their Curriculum Vitae (CV) to CEFIPRA for uploading on CEFIPRA's Website. For doctoral fellowship, the minimum eligibility qualification is Master in science.

## CEFIPRA'S FELLOWSHIP FOR POST-DOCTORAL STUDENTS

CEFIPRA provides opportunity for Post-doctoral student to work under collaborative & Industrial Research project of CEFIPRA. Support covers international travel and a consolidated fellowship per month which covers stay, living expenses & local travel. The minimum eligibility qualification is doctorate in science. CEFIPRA does not directly select students for the supported project. However, students interested in associating with CEFIPRA projects can upload their CVs on CEFIPRA website to bring them to the attention of respective Principal Investigators who may contact them directly.

*For more details regarding eligibility, application process and deadlines please visit [www.cefipra.org](http://www.cefipra.org)*



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

Pour toute information complémentaire, veuillez contacter:

**Director**

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