TACKLING THE CORONAVIRUS TOGETHER

Newsletter of the Indo-French Centre for the Promotion of Advanced Research
Dear Readers,

The ongoing COVID-19 pandemic poses an unprecedented global crisis to public health worldwide, and has surpassed more than 10 million infected cases in around 213 countries. Despite triggering intense global R&D activity to develop vaccine, therapeutics against the disease, the global landscape of COVID-19 vaccine development activity requires global collaborations. Both country leaders have expressed their commitment towards the domestic and international aspects of the crisis and underlined the importance of global collaboration, and the need for scientific community of India and France to work together and share resources to address this global challenge.

The World Health Organization (WHO) has pooled in resources and scientists from across the world in its search for a potential vaccine. In WHO programmes, India along with France are playing a significant role. Particularly, in France, Alliance for Life Sciences and Health (Aviesan) which is accelerating research through REACTing, a consortium coordinated by INSERM and has selected 20 initiatives including mathematical modeling to curb COVID-19. This also includes European project and clinical trial called DISCOVERY, funded by the French Ministries for Health & Solidarity and Higher Education, Research & Innovation. From the Indian side, Department of Science & Technology (DST) has launched numerous initiatives to combat COVID-19 global pandemic and set up a “Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH). Science and Engineering Research Board (SERB), has announced several special research projects which have been selected for development into implementable technologies to ramp up national R&D efforts against the pandemic. Indian scientists supported, by CSIR, have developed nearly 200 tech solutions to fight COVID-19, including tracing testing solutions and research activities on treatments or preventions such as repurposing of existing drugs.

CEFIPRA is also playing an active role between the two scientific communities to facilitate future collaborations amid this pandemic. The Centre has prepared a compilation of latest products and technologies developed by French Scientific and Industrial organizations, which we are sharing in this edition of our newsletter.

CEFIPRA facilitated the return of many Indian students from France through ‘Vande Bharat Mission’ of Ministry of External Affairs, GoI.

Every issue of CEFIPRA celebrates the accomplishments of our scientists: from innovative solutions addressing community. In this issue, we present highlights of some French and Indian efforts related to COVID-19.

Dr. Purnima Rupal
Director, CEFIPRA
INSERM coordinates a clinical trial to evaluate four experimental treatments for COVID-19

Managed by the French National Institute of Health and Medical Research (INSERM) as part of the consortium REACTing (REsearch and ACTion targeting emerging infectious diseases), this trial will include 3200 European patients from Belgium, France, Germany Luxembourg, the Netherlands, Spain, Sweden, and the United Kingdom. In France, at least 800 COVID-19 patients will be recruited in regular medicine departments or in intensive care units.

Discovery is a European project, the French part of which is financed by the Ministries of Higher Education, Research and Innovation (MESRI) and Health and Solidarity (MSS). The European part is supported in part by other projects including COMBACTE, PREPARE and RECOVER. The trial is coordinated by Florence Ader, infectiologist in the Department of Infectious and Tropical Diseases at the Croix-Rousse Hospital of Lyon University and a researcher at the CIRI International Research Centre in Infectiology (Inserm/CNRS / Claude Bernard University Lyon 1).

The objective of the trial is to evaluate the efficacy and safety of four experimental therapeutic strategies which, in light of latest scientific information, might be effective against COVID-19. The therapeutic strategies include the standard of care along with the anti-viral drugs, remdesivir; combination of lopinavir and ritonavir; combination of lopinavir, ritonavir and interferon beta and standard of care plus hydroxy-chloroquine.

Inclusion of patients to the various treatment modalities will be randomized, i.e. by random draw, but patients and physicians will know which treatment is used (called an open trial). The analysis of treatment efficacy and safety will be evaluated 15 days after inclusion of each patient. This trial will also complement the data that will be collected as part of another international clinical trial called Solidarity that will begin under the framework of the World Health Organization, called Solidarity.

The projected conclusion date has been fixed for March 2023, three years after the starting date. Meanwhile, certain partial reports on the efficacy of those molecules in the treatment of COVID-19 have been made public. Their conclusions are somewhat contradictory.

The U.S. National Library of Medicine of the National Institutes of Health has referenced 1133 clinical trials on COVID-19 as of early May 2020. The treatments that seem to draw attention are centered on plasma therapy and hydroxychloroquine, chloroquine, and the combination lopinavir/ritonavir. The antiviral molecule remdesivir has a moderate appeal in the clinical fraternity, despite being widely enunciated. State of the art therapies using protein and cells have attracted less importance, despite their tall promises in other infections.

The European trial ‘Discovery’ mentioned above had aroused high hopes; however, the current situation is somewhat discouraging as the participation of many partner countries is rather disappointing. Efficacy of remdesivir is inconsistent. The combination lopinavir/ ritonavir is also not up to expectation. Thorough investigations are eagerly awaited to resolve the contradictory data on the efficacy of hydroxychloroquine and chloroquine. Taken together, as of May 2020, no therapeutic strategy could be recommended despite the dire need.

For further reading:
- https://clinicaltrials.gov/ct2/show/NCT04315948
- https://www.researchgate.net/publication/341394049_COVID19_An_Update_About_the_Discovery_Clinical_Trial
COVID-19, the disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has created a medical, financial and societal crisis of unprecedented dimensions affecting every continent of the globe, with more than 10 million confirmed cases and half a million deaths at the end of June 2020, and numbers still rising in many countries. Faced with this devastating disease, scientists of all nationalities and diverse disciplines have attempted to put their knowledge and expertise to work for the common good, to understand the mode of infection of the virus, the factors of susceptibility and the disease process, and finally, cellular and molecular targets that can be manipulated for its prevention or treatment.

The “Development and Plasticity of the Neuroendocrine Brain” laboratory in Lille, France, directed by Dr. Vincent Prevot, previously a CEFIPRA principal investigator, consists of neuroscientists and physicians from several countries including India, and has obtained the highest excellence ranking by the French National Institute for Health and Medical Research (INSERM). We work mainly on a small region at the base of the brain called the hypothalamus that both produces and receives a number of hormonal signals from other brain regions and organ systems, to control a vast spectrum of physiological processes from reproduction, growth and stress, to feeding and energy metabolism or water balance. While COVID-19 has been considered a respiratory disease, with viral pneumonia and respiratory and multi-organ failure being the principal cause of death, many of the reported symptoms could also have a neurological origin. For instance, headaches, seizures, dizziness, nausea and confusion can all stem from brain inflammation, while the loss of the senses of smell and taste, which occurs in the large majority of COVID-19 patients, could either come from damage to sensory neurons in the nose or tongue or from parts of the brain that perceive and integrate smell and taste. In addition, heart and lung function, which fail in many seriously ill patients and often do not respond to conventional treatments such as artificial ventilation, are also controlled by a part of the brain called the brainstem. Indirect evidence of potential brain infection has also come from the fact that, in rare cases, changes in brain imaging are visible in patients with neurological symptoms. While other scientists have also noted these clues and speculated that the brain could be affected by SARS-CoV-2 infection, most investigations so far have not found the virus in the brain, or found it only in the cerebrospinal fluid or blood vessels. Similarly, the only confirmed molecule that the virus binds to on the host cell surface in order to put their knowledge and expertise to work for the common good, to understand the mode of infection of the virus, the factors of susceptibility and the disease process, and finally, cellular and molecular targets that can be manipulated for its prevention or treatment. Similarly, the only confirmed molecule that the virus binds to on the host cell surface in order to put their knowledge and expertise to work for the common good, to understand the mode of infection of the virus, the factors of susceptibility and the disease process, and finally, cellular and molecular targets that can be manipulated for its prevention or treatment.
that have fenestrations (literally, windows) to allow signals from peripheral organs to access regulatory circuits, aided by a specialized type of glial cells called the tanycytes.

With the aid of funding from our European Research Council Synergy grant #2019-WATCH-810331 (Well-Aging and the Tanycytic Control of Health), we approached this question from a variety of angles. SARS-CoV-2, like other coronaviruses, needs two molecules to enter its host cells: a protease that cuts the spike protein on the envelope of the virus, and a receptor that the cleaved spike protein binds to, triggering the entry of the virus. As we had predicted, our bioinformatician and postdoctoral fellow Sreekala, a previous CEFIPRA grantee, found by analysing the Allen Human Brain Atlas, an open resource that documents the expression of several thousand genes in uninfected donor brains, that both the hypothalamus and related regions involved in cardiorespiratory function, smell or taste expressed the viral receptor ACE2 and the most commonly used protease, transmembrane protease, serine 2 (TMPRSS2). Among other genes whose expression was positively or negatively correlated with that of ACE2 or TMPRSS2 in these regions, several belonged to distinct functional groups of potential importance to viral susceptibility or the disease process, and a number of individual genes were common to more than one type of function or more than one region. The hypothalamus and connected regions could thus indeed be infected by the virus, with ACE2- or TMPRSS2-correlated genes playing important roles in the perception of smell, taste or the hypothalamic regulation of multiple bodily functions. Intriguingly, some of the overlapping genes were also those whose expression was found by another group to be modified by SARS-CoV-2 infection in the lungs of patients, suggesting common viral disease mechanisms across tissue types.

Next, Florent Sauve, a French PhD student, and other members of the laboratory used fluorescently-labelled antibodies to ACE2 and TMPRSS2 protein to validate our bioinformatics findings above in sections of uninfected human brains, and then in the brain of a patient who died of COVID-19. The results were striking – ACE2, albeit at low levels, and TMPRSS2 were present in tanycytes in a part of the hypothalamus bordered by fenestrated blood vessels. Just as importantly, other cell types, including sensory neurons of the nose, which perceive smell, and their fibres entering the olfactory bulbs of the brain also expressed ACE2 and TMPRSS2. Thus not only could the virus directly affect the sense of smell by infecting these neurons, but could also find its way to other brain regions including the hypothalamus with its other crucial functions, by passing from neuron to neuron along olfactory pathways. In both regions, the virus itself appeared to increase the expression of its receptor to promote infection. We also found several viral proteins as well as double-stranded RNA, an indicator of viral replication, in a large number of cells of the hypothalamus and the olfactory bulb. Strikingly, in the hypothalamus, tanycytic end-feet were among the most strongly labelled structures for the viral spike protein, confirming our hypothesis that the virus could infect them. However, the viral RNA did not replicate in these versatile cells, which form a bridge between the blood and the cerebrospinal fluid and act as shuttles into the brain for metabolic signals from peripheral organs, suggesting that they were also being used to shuttle viruses from the blood into the brain.

Now that we had shown that the virus could and did enter the brain through the hypothalamus, we next asked whether there was a correlation between known risk factors for severe COVID-19, such as sex or metabolic diseases, and the susceptibility of the hypothalamus to infection. Our laboratory uses several animal models to study how the hypothalamus regulates two processes in particular: the production of sex hormones, which might be involved in the fact that more men fall severely ill and die of COVID-19 than women, and the regulation of energy balance, whose perturbation leads to metabolic diseases such as obesity and type 2 diabetes. Tanycytes play essential roles in both. We therefore used antibodies to ACE2 and TMPRSS2 to study their presence in the hypothalamus of normal male and female mice, as well as male mice given a high-fat diet and female mice whose ovaries had been removed to deprive them of oestrogen. To our surprise but also our satisfaction, the expression of ACE2 and FPR2 in hypothalamic tanycytes and other cells was modified by both high-fat diet and the lack of oestrogen, but in different ways, whose significance we are yet to understand.

To conclude, in a groundbreaking study by a team that notably brings together Indian and French scientists, we have shown that the hypothalamus, specifically tanycytes, as well as olfactory neurons could provide a port of entry for SARS-CoV-2 into the brain, and that hypothalamic circuits could act as a hub for the numerous risk factors as well as the physiological effects of viral infection. Future studies will reveal exactly what cellular and molecular pathways are triggered by viral infection, and whether they can be targeted to improve the outcome of severely ill patients.

Further Reading:
https://www.biorxiv.org/content/10.1101/2020.06.08.139329v2
Gamut of COVID-19 Vaccines & Drugs Research

India's first COVID-19 vaccine candidate COVAXIN gets DCGI approval

This vaccine is developed in collaboration with the Indian Council of Medical Research (ICMR) and the National Institute of Virology (NIV). The SARS-CoV-2 strain was isolated in NIV, Pune and transferred to Bharat Biotech. (Source: www.cnbctv18.com)

![COVAXIN | Photograph Courtesy: www.cnbctv18.com](https://www.cnbctv18.com)

France-based drugmaker Sanofi pushed up large scale human trials

Researchers at Sanofi are set to bring in a protein antigen. This is a molecule designed to trigger an immune response in the body. This will be done based on a platform that Sanofi utilizes for its influenza vaccine Flublok. On its part, GSK will contribute one of its approved adjuvants. This works through boosting the immune response to produce more antibodies and longer-lasting immunity. (Source: www.financialexpress.com)

![Sanofi's COVID-19 vaccine will rely on the technologies underpinning its Flublok flu vaccine | Photograph Courtesy: www.bioworld.com](https://www.bioworld.com)

CSIR-CDRI Lucknow gets approval for trial of drug Umifenovir

Umifenovir has a good safety profile and acts by preventing entry of virus into human cells and also by priming the immune system. Umifenovir is mainly used for treatment of influenza and is available in China and Russia, and has recently come into prominence due to its potential use for COVID-19 patients. (Source: www.financialexpress.com)

![Umifenovir | Photograph Courtesy: www.financialexpress.com](https://www.financialexpress.com)

CSIR-CDRI Lucknow gets approval for trial of drug Umifenovir

![Umifenovir | Photograph Courtesy: www.financialexpress.com](https://www.financialexpress.com)

Squalene-based multidrug nanoparticles for improved mitigation of uncontrolled inflammation in rodents

Studies on confirmed COVID-19 cases have suggested that mortality rate is high due to virally induced hyperinflammation. Researchers from Institut Galien (Paris-Saclay University/CNRS) reported on the development of multidrug nanoparticles for the mitigation of uncontrolled inflammation. These nanoparticles are made by conjugating squalene, a natural lipid, to adenosine, an endogenous immunomodulator, and then encapsulating α-tocopherol, as antioxidant. (Source: ScienceAdvances, DOI: 10.1126/sciadv.aaz5466)

![Electron microscopic image reveals the crown shape structural details for which the coronavirus was named. Image Courtesy: National Institute of Allergy and Infectious Diseases (NIAID)](https://www.niaid.nih.gov)

Indian pharmaceutical giant Sun Pharma gets approval for Nafamostat drug trial

Researchers have found that a very low concentration of Nafamostat suppresses a protein (TMPRSS2) that the COVID-19 virus uses to enter human lung. Additionally, scientists with
Institut Pasteur in South Korea reportedly compared the antiviral efficacy of this drug and 24 other drugs against SARS-CoV-2 in vitro studies in human lung epithelial derived cells, finding Nafomostat to be the most potent drug. (Source: www.outsourcing-pharma.com)

**Pasteur Institute is developing coronavirus vaccine candidate**

This vaccine candidate uses a live-attenuated measles vaccine virus with antigens from SARS-CoV-2 added to it. Antigens are molecules or proteins present on the surface of the virus that create antibodies in humans and animals to fight against the same microbe. The antigens will be selected based on the previous experience of the Pasteur Institute with a measles-based vaccine candidate against SARS which was shown to be efficacious against SARS in mice. (Source: http://www.rfi.fr/)

**Indo-French researchers developed molecules that can cure as well as prevent COVID-19**

A team of researchers from Shiv Nadar University and Institute Cochin (INSERM, CNRS, Université de Paris, France) has discovered molecules that can be developed into a drug that can not only cure but also prevent diseases like COVID-19 and SARS. As stated by research team, these New Chemical Entities (NCEs) have the ability to heal severe respiratory problems like Acute Respiratory Distress Syndrome (ARDS) or Acute Lung Injury (ALI) induced by COVID-19 (SARS-CoV-2) or other Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). (Source: www.edexlive.com)

**Development of a DNA vaccine candidate**

DNA vaccination is a technique for protecting against disease by injecting DNA encoding of a specific antigen. The injected DNA triggers a protective immunological response, for example the production of antibodies against the antigen. Two antigen candidates have already been designed, based on the S (spike) protein of the virus, responsible for the “crown” (“corona” in Latin) observed at the surface of coronaviruses, after which they were named. (Source: www.pasteur.fr)

**Cadila-CSIR’s sepsis drug shows promise in fight against COVID-19**

The researchers explained that Sepsivac is a therapeutic vaccine that will kick-start the innate immunity. As there are two kinds of immunity in our body — innate immunity that we are born with and get from our ancestors and the acquired immunity. Acquired immunity is mostly governed by antibodies. Whenever a virus or bacteria attacks our body, the innate immunity or trained immunity reacts first. This vaccine will boost this trained immunity or what we call scientifically, Th1 (T helper type 1). (Source: www.business-standard.com)

**Prophylactic vaccine candidate for SARS-CoV-2, based on lentiviral vaccine vectors**

(Representative Image | Image Courtesy: www.drugtargetreview.com)

(Chemical Structure of Nafamostat | Image Courtesy: Wikipedia)

(The research shows detected antibody response appears to grow stronger as patients recover | Photograph Courtesy: Chesnot/Getty)

(DNA Strands | Photograph Courtesy: www.technologynetworks.com)

(SEPSIVAC | Photograph Courtesy: www.cadilapharma.com)
Lentiviral vaccine vectors are particularly useful because of their potential to induce long-lasting adaptive immune responses. These vaccine vectors encode immunogens that protect against SARS-CoV-2 viral surface proteins (spike or nucleocapsid).
(Source: www.pasteur.fr)

Researchers from IIT-Roorkee working on identifying antivirals
The identification of structure-based potential antivirals in mitigation of SARS-CoV2 has garnered the assist of the Science and Engineering Analysis Board (SERB) beneath the Division of Science and Expertise (DST).
(Source: www.cqai520.com)

French industry started world’s first study of an antibody treatment against the disease
Eli Lilly and Co (LLY.N) started an early-stage trial to test its potential treatment for COVID-19. Lilly’s treatment is an antibody directed against the spike-shaped protein structures of the virus and is designed to block it from locking on to human cells, thus neutralizing the virus.
(Source: https://egyptindependent.com/)

Indian industry at an advanced stage to deliver COVID-19 vaccine
Pune-based Serum Institute is manufacturing a promising vaccine developed by the University of Oxford, called ChAdOx1 nCoV-19; this vaccine uses a weakened version of the virus that causes the common cold in chimpanzees to carry particular genetic material from SARS-CoV2 virus which makes proteins that help the COVID-19 virus to human cells.
(Source: www.thehindubusinessline.com)

COVID-19 treatment with hydroxychloroquine & azithromycin in Marseille, France
The researchers concluded that the administration of HCQ+AZ combination before COVID-19 complications occur is safe and associated with a very low fatality rate in patients.
(Source: Elsevier, DOI: https://doi.org/10.1016/j.tmaid.2020.101738)

- Compiled by
Dr. Raman Kumar
Scientific Associate
CEFIPRA

CEFIPRA extends warm welcome to Prof. Thierry Weil as new IRC member
Dr Thierry Weil has been working as a Professor at Mines ParisTech, where he holds an endowed chair on the future of industry and work, and as a consultant in the field of technology management and strategy. From December 2000 to May 2002, he has been the Scientific Advisor of the French Prime minister Lionel Jospin. From 2011 to 2017, he led "La Fabrique de l’industrie", a think tank chaired by Louis Gallois, Chairman of PSA Peugeot Citroen and Pierre-Andre de Chalendar, Chairman of Saint-Gobain, aimed at fostering industrial development in France and Europe.
Dr Thierry Weil is the author of twelve books, over 60 scientific papers, several patents and over 200 conferences and popularised papers. One of his books has been translated into English, Italian, Korean and Chinese (On leadership, James G. March & Thierry Weil).
Goa - Atlantic cooperation programme (GOAT) in Brest, France

Marine Science and Technology has been highlighted in the common declaration during the visit of the Indian Prime Minister to France (August 2019), considering the Letter of Intent signed by IIT Goa, CMM and NG during the first Knowledge Summit in New Delhi (8 December 2017), the GOAT Partners have agreed in moving ahead with the GOAT project and sign a Memorandum of Understanding.

The goal of the CEFIPRA’s supported Seminar was to establish bridges between individual academics, scientists and engineers in order to create links that support the signature of an MoU between IIT Goa and Campus Mondial de la Mer (CMM), Pôle Mer Bretagne Atlantique (PMB), École Nationale d'Ingénieurs de Brest (ENIB), École Nationale Supérieure de Techniques Avancées Bretagne (ENSTA-B), École Navale, Université de Bretagne Occidentale (UBO), France Energies Marines (FEM), Service Hydrographique et Océanographique de la Marine (Shom), and Naval Group (NG).

Participants deliberated on various modes for Educational, Research and Innovation exchange Programme in the area of Marine Science and Technology. Indian partners had also the chance of meeting more than 50 French academics, researchers and engineers, which includes Pierre-Yves MORVAN (IxBlue), Anne Lebourge Dhaussy (IRD), Emmanuelle Platzgummer, (Officer in charge of Asia at IFRMER), as well as Mrs. Béatrice Nicolas-Meunier, Mr. François-Régis Boulvert, and Mr. Luc Martin (Naval Group). The Parties have mutual interests and intent to undertake cooperative activities to their mutual benefits in education and research, mainly in the following fields:

- Renewable marine energy,
- Advanced computational techniques, numerical modelling and mathematics,
- Combustion technologies,
- Chemical,
- Marine biotechnologies,
- Non-destructive evaluation and control,
- Bio environment,
- AUV: sensors, imaging, data processing and interpretation, autonomy,
- Acoustics,
- Physical oceanography and ocean sensors,
- Marine physics: ocean and climate, geophysics, hydrodynamics, and ocean data science.

Twelve major cooperation topics have already been identified by NG and IITG with contact points from each country : Non Destructive Test tools; Friction Steer Welding; Circuits of freshwater, chilled water and seawater; Polymers and hydraulic fluids; Physicochemical analyses; Acoustic Imagery; Digital twins / predictive Maintenance; Underwater communication and control; Scientific Computing; Environmental Protection & Eco Design; Bigdata and learning technologies.

The Memorandum of Understanding was signed at Brest Metropole on January 19 2020

Seminars

27th STIP lecture on ‘Space Technology & Application for Development’

The CEFIPRA-IHC-RIS Science, Technology and Innovation Policy (STIP) Forum lecture on “Space Technology & Applications for Development” was delivered by Dr. P. G. Diwakar, Distinguished Scientist, ISRO, Director, Earth Observation Applications & Disaster Management ISRO HQ. The 27th STIP lecture was organized by CEFIPRA and chaired by Dr Bhaskar Balakrishnan, Science Diplomacy Fellow, RIS, New Delhi.

Dr. Diwakar, a Scientist in ISRO for the past 35 years presented an overview of ISRO and major projects they took up over the past four decades in space research. He gave an insight of various satellite launch vehicles and briefed the audience regarding ongoing projects and umpteen numbers of new initiatives taken by ISRO in space research. He stated on how each one of us are connected to space in one or the other way through communication satellites placed by ISRO. He brought the role played by ISRO navigation and remote sensing satellites in applications such as geo-fencing, geo-tagging, identifying fish catchment areas, crop management, forest fire detection, mapping water bodies etc. He also highlighted the innovative technologies adapted in the successful conduction of their milestone projects Chandrayana – I and Mangalayana – I.
In the seminar, seventeen speakers from India and eight speakers from France participated along with fifty-five research scholars. Prof Sandeep Juneja, Dean, School of Technology and Computer Science, TIFR Mumbai was the Chief Guest & Dr Purnima Rupal, Director CEFIPRA was the Guest of Honor.

Deliberations covered vector optimization problems their sensitivity, uniform efficient solutions, extended real valued functions, their applications using sub differentials, Set valued optimization, essential solution sets in set-valued optimization, variational principles for set valued maps and applications, blind deblurring of barcodes as a complementarity constraint optimization problems, mathematical programming problems with equilibrium/vanishing constraints & their applications, shape optimization problems, bi-level programming & its applications, Variational mollifier approach to deconvolution of probability densities & applications, monotone variational inclusions, gradient based line search method for multi-objective optimization problems, spherical search algorithm and solid waste management problems.

The young faculty members, post-doctoral fellows and research scholars benefitted from the exposure to the current research in Optimization, Variational Analysis and applications in India and France. The Seminar was well attended by French and Indian researchers from University of Limoges, University of Toulouse (ENAC), University of Rennes (INSA), CMAP-Ecole Polytechnique, Palaiseau, University of Avignon & Chennai Mathematical Institute, Indian Statistical Institute, Delhi & Chennai, Aligarh Muslim University, University of Delhi, IIT Kanpur, Roorkee Patna and Kharagpur working in the area of Operational Research. This event was also well covered in local media. University of Limoges expressed a keen desire to exchange Masters Students with Deptt. of Mathematics, Institute of Science, Banaras Hindu University, Varanasi.

Interactions among Indian Optizers and French Optizers were very fruitful. Young students also got a chance to interact with French as well as Indian experts. Young research scholars got an exposure of the research work being carried out by leading French Optizers. It was discussed that Mathematical Programming Problems with Equilibrium Constraints and Mathematical Programming Problems with Vanishing Constraints are very much applied to various disciplines of Science and Engineering.
Small molecules activation for fuels and commodity chemicals production

In this seminar, twenty speakers from India and twelve speakers from France were participated along with sixty research scholars as beneficiaries. This seminar also provided the opportunity to plan student exchanges and long term collaboration between the participating institutes. Institutional linkages were developed among Labex Arcane in Grenoble with the Indian Chemical Community/Society. Specific discussions have been made with consortium at IACS, IIT Gandhinagar and IIT Mumbai to discuss the need to transition towards a sustainable way of producing fuels and chemical. The seminar brought together different domain experts encourage sufficient discussion time and student presentations. The sessions greatly enriched the Brainstorming sessions benefited the seminar in envisaging several new Indo-French collaborations.

“Solar-Driven Chemistry” emerges as a new concept to making sustainable fuels and commodity chemicals at affordable materials and Earth surface costs, using solar energy as the only energy source and through the activation of readily available small molecules from this atmosphere, enabling the foundation of a global circular economy. This includes hydrogen production from water, nitrogen, NOx and SOx fixation and the conversion of atmospheric CO₂ into products, which will be a game changer in the fight against climate change and, last but not least, the control of oxygen activation to prepare advanced functionalized chemicals. To achieve this goal, there is a strong need to develop radically new catalytic technologies to control the activation of such small molecules. The idea of designing novel biohybrid-matrixes for enhancing catalysis was also discussed.

The activation of small molecules has long been the realm of bioinorganic chemistry, but in this seminar, the Coordinators abled to gather scientists which are working on developing nanocatalysis, catalysis for organic transformation and surface science in order to make the field progress towards industrial catalytic applications.

4-6 February, 2020 at Indian Association for Cultivation of Sciences, Kolkata, West Bengal

Indian Coordinator:
Prof. Abhishek Dey
Indian Association for the Cultivation of Science
Kolkata

French Coordinator:
Dr. Vincent Artero
CEA Centre de Grenoble
Grenoble
CEFIPRA's Scientific Meetings

65th Scientific Council (SC)
The 65th meeting of the Scientific Council (SC) was held on 27 May, 2020 through videoconferencing. After initial screening at CEFIPRA, the SC considered 37 proposals, 23 from thematic areas [AI & Big Data (9), Science for Sustainability (3), Quantum Materials (5), Addressing Biological Questions Using or Developing Mathematical, Computational or Physical Approaches (6)], 14 from general areas [Computational Science (1), Life and Health Sciences (1), Pure and Applied Physics (1), Pure and Applied Chemistry (2), Earth and Planetary Sciences (2), Materials Science (6) and Environmental Science (1)] and rejected 3 proposals due to administrative reasons.

36th Industrial Research Committee (IRC)
The 36th meeting of the Industrial Research Committee (IRC) was held on 29 May, 2020 through videoconferencing. A total of five proposals from various thematic areas [Machine Learning (1), Oenology (1), Nutrition (1), Ophthalmology (1) and Affordable healthcare (1)] were evaluated by the expert panel members, out of which three innovative projects were considered for support. The Committee also discussed on improvement of visibility of CEFIPRA’s Industry-Academia Programme with Industrial clusters in India and France.

5th Standard Expert Panel (SEP)
CEFIPRA organized its 5th meeting of the Standard Expert Panel (SEP) on 17 June, 2020. The agenda of this meeting was to mentor and monitor the Indian & French collaborators of CEFIPRA supported projects on Intellectual Property (IP) rights and commercial potential of their joint projects. A total of 42 Project Investigators (PIs) were contacted, both Indian and French to participate in this meeting. Of these, 20 PIs, (14 were Indian and 6 French) 16 from Collaborative Scientific Research Programme (CSRP) and 4 from Industry Academia Research Development Programme (IARDP) attended this meeting via skype. Various issues related to Intellectual Property (IP) management were addressed by SEP members and a special Invitee IRC member of CEFIPRA. PIs were encouraged to file more patents, whenever patentable outcome is available under their joint research programme.

Expert Committee Meeting
CEFIPRA organized meeting of the Expert Committee under DST-Inria Targeted programme on 5 February, 2020 at CEFIPRA office, New Delhi for evaluation of proposals submitted against the 7th Call for proposals.

Targeting the interest of both DST & Inria, two projects were recommended for support by the Committee. The 7th call was announced in following areas viz. Big Data, Computer science for Biology and Life Sciences, Artificial Intelligence, Cyber Physical Systems, ICT and Applied Mathematics. The Committee also reviewed five completed projects which were graded as following Excellent (1), Very Good (3) & Good (1), along with progress review of eight ongoing projects.
Biodegradable electrospun mats and 3-D printed interconnected porous scaffolds for anticancer drug delivery and tissue engineering applications

Engineering an ideal scaffold for anticancer drug delivery, and tissue engineering is a challenging task. For anticancer drug delivery, scaffolds with targeted and sustained drug delivery were designed in order to eliminate the drugs effect on healthy cells as well as side effects such as metabolic imbalance, kidney damage, nausea, etc. Similarly, developing a biocompatible biomaterial with the desired mechanical properties is crucial for tissue engineering applications. Considering these facts, we have framed the objectives of the project to develop hydrophobic electrospun mats for sustained delivery of anticancer drugs and a porous interconnected scaffold for tissue engineering applications.

Outcome of the Project

- Fabrication of nontoxic, mechanically stable and biocompatible Boron Nitride (BN)-reinforced gelatin electrospun mats (ESM) for orthopedic applications
- Synthesis of Polycaprolactone (PCL) electrospun fibers optimized for the delivery of dual anticancer drug that could be used as patches for cancer treatment
- Engineering of the sacrificial mold to fabricate gelatin scaffolds with tunable pore size and architecture for biomedical applications
- Development of 3-D printed PCL based scaffolds containing silver nanoparticles and bone mineral for preventing infection in bone tissue engineering
- Biomimetic fabrication of native fibrillar collagen loaded with kaempferol for bone tissue engineering application

1. Fabrication of boron nitride loaded electrospun fibres

Gelatin electrospun fibers display poor mechanical properties. However, inorganic 2D nanosheet boron nitride (BN) showed high mechanical properties. Hence, BN was exfoliated using gelatin and ultrasonication. Exfoliated BN was inserted into electrospun fibers using various BN concentrations: 0, 0.1, 1, and 5%, which are denoted as 0GC, 0.1GC, 1GC, 5GC, respectively. The gelatin/BN electrospun fibers were crosslinked with glutaraldehyde and neutralized with glycine solution. SEM micrograph shows the fibrous morphology of the ESM (figure 1). Mechanical properties (Young’s modulus) of the BN reinforced fibers which is comparable to the cancellous bone were enhanced three fold compared to the pristine gelatin. Our results show that reinforcement of BN nanosheets with electrospun fibers is a promising method to improve the mechanical properties of gelatin. ESMs are highly bioactive, stable, biocompatible with the improved mechanical properties, making it suitable for orthopedic applications.

2. Fabrication of electrospun scaffolds for sustained drug release

Polycaprolactone (PCL) is a biodegradable polymer and widely employed for biomedical applications owing to their biocompatibility, biodegradability, and ease of fabrication into different shapes. Apart from the tissue engineering application, PCL is also widely utilized as a drug delivery carrier for the delivery of a wide range of drugs using different formulations. In this study, PCL was used to fabricate electrospun fibers. Various anticancer drugs such as curcumin, doxorubicin, and mixture of curcumin and doxorubicin incorporated electrospun fibers were fabricated. Furthermore, drug release profile from the electrospun fibers and the influence of drug-loaded electrospun mats (ESM) on melanoma cell viability was analyzed. Curcumin, doxorubicin, curcumin/doxorubicin loaded ESM are denoted as PC, PD, and PCD, respectively. Morphology and the size of the electrospun...
fibers in the ESM were shown in figure 2. It is found that the PC fibers display heterogeneous fiber sizes ranging from 200 nm to 2.25 µm and PD fibers are 200 nm to 1.3 µm. Whereas PCD fibers are homogenous and below 600 nm and display more distribution of fibers below 300 nm, which is crucial for drug release due to their high surface area. In addition, the drug release data confirms the high drug release from the PCD samples. Dual anticancer drug-loaded electrospun fibers display sustained drug release. Cytotoxicity tests evidenced that the PCL is highly biocompatible and release of anticancer drugs induces cytotoxicity to the melanoma cancer cells. The synthesized ESMs are suitable for the fabrication of patches to treat cancer.

4. Development of 3-D printed PCL-AgNPs scaffold by in-situ formation of silver nanoparticles in PCL polymer matrix followed by 3-D printing

The 3-D printing technology is widely used to rapidly develop a scaffold with controlled architecture and interconnected porous structures. The 3-D printed scaffold helps in the exchange of nutrients and metabolic waste within the scaffold resulting in cell infiltration. Here we fabricated a 3-D matrix composed of PCL and silver nanoparticles using fused deposition modeling (FDM) technique. Silver nanoparticles were synthesized in-situ within the PCL polymeric suspension by reduction method. Furthermore, the scaffold made from PCL, in-situ reduction of PCL with 10 percent silver nitrate, and in-situ reduction of PCL with 30 percent silver nitrate will be denoted as PCL, 1Ag2 and 3Ag2 and the printed matrix is shown in figure 5(A). SEM micrograph revealed the PCL 3-D matrix with uniform porous structures with open and interconnected pores and arrow indicates the incorporation of silver nanoparticles (figure 4(B)). Besides, the 3-D matrix exhibited biocompatible and bactericidal properties, which could be used as a scaffold for inhibiting the bacteria growth in the infected site to accelerate the tissue regeneration process.

3. Sacrificial Mold assisted 3D printed scaffolds for tissue engineering application

Gelatin has been explored as a biomaterial for tissue engineering application due to their biocompatibility, biodegradability, and extra cellular matrix mimicking chemical constituency. Designing scaffolds with appropriate pore size and cell adhesion molecules are essential for scaffolds employed in tissue engineering. However, engineering the gelatin scaffold with appropriate architecture is crucial for tissue engineering application. Here, customized gelatin scaffolds were developed using 3D printed polyvinyl alcohol (PVA) sacrificial mold. Sacrificial PVA molds were fabricated using various percentage in-fills such as 40, 55, and 65, and gelatin scaffolds fabricated using respective PVA scaffolds are denoted as G40, G55, G65. Novel scaffolds were prepared using gelatin, which is highly insoluble and stable, using 3D printed PVA sacrificial mold (figure 3(a)). Gelatin scaffolds are insoluble and display no significant weight loss, revealing its stability. The biocompatibility of the scaffolds was confirmed using MG63 cell lines. Furthermore, cell attachment studies showed that the gelatin scaffolds facilitate cell attachment and proliferation without immobilizing any cell adhesion molecules (figure 3(b)). This study demonstrates that careful engineering of the sacrificial mold allows the fabrication of gelatin scaffolds with tunable pore size and architecture for biomedical applications.

5. Fabrication of 3-D printed PCL-silver doped biphasic calcium phosphate for tissue engineering application

Tissue engineering approaches combine biodegradable scaffolds with bioactive factors to regenerate the damaged tissue. We fabricated a 3-D matrix composed of PCL biphasic calcium phosphate, and silver doped biphasic calcium phosphate by wet precipitation method. The biphasic calcium phosphates used will be progressively resorbed and substituted by newly formed bone and hence will be beneficial in bone tissue engineering. The doping of silver will add the antibacterial properties to the material. Furthermore, the scaffold printed from PCL, PCL with 20 percent silver doped biphasic calcium phosphate, PCL with 20 percent silver doped biphasic calcium phosphate and PCL with 30 percent silver doped biphasic calcium phosphate will be denoted as PCL, PCL-SHAP, PCL-20%SAgHAP, and PCL-30%SAgHAP respectively (figure 5(A)). The PCL 3-D matrix consisted of uniform porous structures with open and interconnected pores facilitating the infiltration of cells (figure 5(B)). Moreover, the 3-D matrix exhibited antibacterial and biocompatible property which could be used as a scaffold to prevent infection.
6. Development of collagen-kaempferol scaffold

Collagen is one of the abundant proteins found in the connective tissues and plays a vital role in tissue architecture and function. Collagen-based biomaterial is generally biocompatible and hence is used in a wide range of biomedical applications. Kaempferol is a typical flavonol-type flavonoid found in the wide variety of vegetables and fruits and possesses osteogenic properties. Kaempferol (1, 2 and 5 wt %) was loaded into collagen to improve the tissue regeneration. Collagen-kaempferol scaffold developed by biomimetic method exhibits native structure of the extra cellular matrix tissues, as shown in figure 6. Furthermore, the fabricated scaffold was stable and biocompatible towards bone cells and hence can be used as a biomaterial for tissue engineering application.

Figure 6. SEM micrograph of Coll + 5% Kaemp composite

Impact on career of young researchers

Under this project, Dr. Sakthivel Nagarajan and Dr. Socrates Radhakrishnan from Crystal Growth Centre, Anna University, Chennai, had an opportunity to work under Dr. Mikhael Bechelany’s supervision at the Institute of European Membranes, Montpellier. They also got the opportunity to interact and collaborate with researchers from different parts of the world which enabled us to complete the project successfully. Both of them got hands-on experience in electrospinning and 3-D printing techniques to fabricate biomaterials which resulted in the publication of three scientific articles and four book chapters in peer-reviewed journals. In addition, their stint at the Institute of European Membranes, Montpellier helped them to defend their Ph.D theses successfully. Based on the experience gained from this project Dr. Sakthivel could obtain a post-doctoral fellowship at French alternative Energies and Atomic Energy Commission (CEA), Grenoble, France.

Finally, we would like to thank CEFIPRA for providing the financial and administrative support throughout the project leading to the efficient execution of the project. This project will initiate further advanced research in the field of biomaterials between our two groups.

Vande Bharat Mission of MEA, GOI.
Piezoelectric Actuator System for Automotive Translation Systems (PASATS)

PASATS Project In a nutshell

Industrial Research Project, acronymed PASATS is sponsored by Indo French Center for the Promotion of Advanced Research and includes two Academia Partners. From French side it is CentraleSupélec/Group of Electrical Engineering – Paris (GeePs) coordinated by French PI, Laurent Daniel. The second partner is from India - CSIR Central Mechanical Engineering Research Institute, Durgapur coordinated by Indian PI, Saikat Kumar Shome. An Industry Partner also collaborates in this project: Faurecia Automotive Seating (France, Brières-les-Scellés).

Seats play a critical role in driver and passenger experience of any car and account for 5% of a vehicle’s total cost and 6% of its weight. As a result, they represent the second largest expense for automakers. Companies have started to construct new structures that will forever change automotive seating in more ways than one.

This project explores innovative technologies to realise automotive seat motion based on the use of smart actuators in seating arrangement involving product line seat electronics. Piezoelectric actuation is a promising candidate for such systems but some challenges remains to be unlocked. A main challenge is to design a compact piezo actuator able to provide the required power to slide a standard automotive seat. This has to be done with the minimum amount of motion transformation from the motor to the seat frame, keeping the cutting edge advantages of piezoelectric actuation devices. Developing the corresponding electrical amplifier driver circuit is also a challenge, as the voltage source available in car is a battery whereas the piezoelectric actuators operate at voltages near hundred volts besides being highly capacitive in nature.

Role of Project Partners

The objective of this project is to develop a linear piezo-actuator based translation system for automotive applications. French partner GeePs is responsible for the motor development, while the Indian partner, CSIR CMERI deals with development of the electrical driver amplifier to actuate the motor. Faurecia is responsible for the specifications and implementation in an industrial test bench.

Summary of research undertaken

The French side, proposed the design and experimental analysis of a piezo-motor for applications requiring high blocking and driving forces. The proposed mechanical design addresses difficulties associated with high integration flexibility and high blocking force for the motor. The design of the motor was performed using Finite Element Analysis. A motor with a weight of 78 g and dimensions of 100 x 16 x 7 mm³ ensures full clamping ability when not electrically activated. The designed motor provides a clamping force of 2500N with a driving force of 500N. An electro-mechanical model and simulation of the motor was proposed.

The structural design of the motors is the object of a patent in preparation by the French side.

The Indian side worked on the mathematical and electrical modelling of the piezoelectric actuators which is the primary actuator of the Inchworm motor developed by GeePs in the framework of the project. These actuators exhibited high non-linearity during operation and necessary non-linear control algorithms were developed to compensate the

Figure : Experimental test bench to measure speed of the Inchworm motor at high frequency in loaded condition

Fig : a) Experimental set-up bench to measure the pre-stress force of single PZT stack actuator, b) 200N force applied to the PZT stack actuator by CDHT and corresponding output by Force sensor seenin DSO
hysteresis. Three genres of algorithms have been designed - adaptive dither based control algorithms, modified internal model based control law with optimization, Recursive Least Square Based Adaptive Controller which have been published in international journals. The next work package involved developing the three phase shifted control pulses with proper duty cycle and phase shift to actuate the two brakes and extender of the inchworm motor in sync. The driving voltage available from car battery source is 12V, and necessary amplifier driver circuit had to be developed to amplify the voltage to operating voltage of the piezoelectric actuators which is around 120V. Power electronics based circuit has been developed to balance the highly capacitive nature of the piezoelectric actuators which was a main issue while operating at high frequencies (greater than 1kHz). Experiments were conducted to drive the inchworm motor prototype designed and developed by the French team with the high frequency amplifier driver circuit developed by the Indian team at both unloaded and loaded conditions. The project has successfully demonstrated the proof-of-concept of linear actuation system which can be used for automotive seat translation along with high scientific research outputs in the relevant domain. Further IP shall be developed after the patent already submitted is available as a prior-art.

Main achievements (French Side)

- Proposition of two motor designs based on piezoelectric actuators.
- Geometrical modelling of the necessary mechanical system design for automotive applications.
- Prototype development of the actuation system for two different configurations.
- Experimental analysis of the mechanical actuation system.
- Collaboration between the French and Indian sides in order to test the actuation system under different frequency.

Main achievements (Indian Side)

- Mathematical modelling and simulation of the piezoelectric actuators and inchworm motor.
- Design of three adaptive, non-linear control algorithms for piezoelectric actuators with performance evaluation.
- Prototype development of high frequency amplifier driver circuit to actuate the inchworm motor under different control pulse test cases.
- Experimental analysis of the power electronics based electrical actuation system with car battery.
- Interfacing of Inchworm Motor in real time controller environment along with forward and reverse direction control.

Visits

Six visits were executed under the project, three each from French and Indian side. Brief of the visits are as follows: S.K. Shome (India, 2017), L. Daniel and Y. Bernard (France, 2018), S. Ghenna (France, 2018), S.K. Shome and S. Jana (2020).

The project was also impactful towards human resource development. Both the manpowers trained in the project has gained sufficient knowhow, including an opportunity to work in partner laboratories. It must also be mentioned that French Post Doc, Dr. Sofiane Ghenna has been selected as an Associate Professor in France after gaining the research experience through this project.

Finally, all the project partners thank CEFIPRA for funding this network which made it possible to create very strong links between cross-border partners and reach great scientific achievements using complimentary expertise of the partners. We also acknowledge the continuous support of Director, CEFIPRA and specially Dr Payal Prakash for active support towards execution of the project throughout its entire duration.

Team PASATS (Faurecia R&D Center, Brière, France 12 Oct, 2017)

At CSIR CMERI, Durgapur in 2018
Saikat Kumar Shome (In), Partha Bhattacharjee (In), Sandip Jana (In), Yves Bernard (Fr), Laurent Daniel (Fr).

At GeePs laboratory, Paris, in Jan 2020
## Compilation of latest products and technologies developed to curb COVID-19 by French Scientific and Industrial organizations

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Detail</th>
<th>Agency</th>
<th>Web link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COVID-19 VACCINES &amp; DRUGS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Identification and characterization of human monoclonal antibodies neutralizing 2019-nCoV with the potential for development towards vaccine candidates</td>
<td>Inserm, Institut Pasteur</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Potentiating existing nucleoside therapies.</td>
<td>CNRS, Aix-Marseille Université</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Establishment of an antibody profile in convalescing patients and preparation of a serological test applied to an epidemiological survey in people exposed to SARS-CoV-2</td>
<td>Institut Pasteur</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Role of furins in SARS-CoV-2 Spike protein maturation: evaluation of the antiviral potential of furin inhibitors</td>
<td>Aix-Marseille Université, CNRS</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Strategy of repurposing medicines to treat 2019-nCoV infections</td>
<td>Inserm, Université Claude Bernard Lyon 1, École Normale Supérieure, CNRS and International Center for Research on Infectious Diseases – CIRI</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Defective viral genomes (DVGs), potential antiviral inhibitors of SARS-CoV-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Spike glycoprotein, lentiviral vectors and B/T-cell vaccine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Isolating and characterizing the human antibodies that neutralize SARS-CoV-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.No.</td>
<td>Detail</td>
<td>Agency</td>
<td>Web link</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>18.</td>
<td>French scientists are using the measles vaccine to develop a 'Trojan horse' against the coronavirus</td>
<td></td>
<td>DOI: 10.1126 / sciadv.aaz5466</td>
</tr>
<tr>
<td>19.</td>
<td>Squalene-based nanoparticles to treat septic shock and uncontrolled inflammation</td>
<td>Institut Galien (Paris-Saclay University / CNRS)</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>French companies join forces to make 10,000 ventilators in 50 days</td>
<td>Air Liquide</td>
<td><a href="https://www.ft.com/content/42f636be-791d-4ebf-9b55-bf313014769f">https://www.ft.com/content/42f636be-791d-4ebf-9b55-bf313014769f</a></td>
</tr>
<tr>
<td>30.</td>
<td>Inserm launches a project to recycle masks</td>
<td>INSERM</td>
<td><a href="https://presse.inserm.fr/en/milestone-inserms-commitment-to-the-fight-against-the-covid-19-">https://presse.inserm.fr/en/milestone-inserms-commitment-to-the-fight-against-the-covid-19-</a></td>
</tr>
</tbody>
</table>

**VENTILATORS AND RESPIRATORS**

**ANTI COVID PPEs AND MASKS**
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Detail</th>
<th>Agency</th>
<th>Web link</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.</td>
<td>Mask</td>
<td>Cole-Parmer</td>
<td><a href="https://www.coleparmer.fr/p/moldex-n95-particulate-respirators/16867">https://www.coleparmer.fr/p/moldex-n95-particulate-respirators/16867</a></td>
</tr>
<tr>
<td>39.</td>
<td>Face shields</td>
<td>CAD vision</td>
<td><a href="https://covid3d.org/">https://covid3d.org/</a></td>
</tr>
<tr>
<td>40.</td>
<td>PPE and Masks</td>
<td>Drager France SAS</td>
<td><a href="http://draeger.com/corona">http://draeger.com/corona</a></td>
</tr>
</tbody>
</table>

**MATHEMATICAL MODELLING AND ARTIFICIAL INTELLIGENCE (AI)**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Detail</th>
<th>Agency</th>
<th>Web link</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.</td>
<td>Mathematical model indicates that between 3% and 7% of french people have been infected</td>
<td>Institut Pasteur and the CNRS, in collaboration with Inserm, DREES and Santé Publique France</td>
<td><a href="https://www.pasteur.fr/en/research-journal/press-documents/covid-19-mathematical-model-indicates-between-3-and-7-french-people-have-been-infected">https://www.pasteur.fr/en/research-journal/press-documents/covid-19-mathematical-model-indicates-between-3-and-7-french-people-have-been-infected</a></td>
</tr>
<tr>
<td>43.</td>
<td>France is using AI to check whether people are wearing masks on public transport</td>
<td>Datakalab</td>
<td><a href="https://www.theverge.com/2020/5/7/21250357/france-masks-public-transport-mandatory-ai-surveillance-camera-software">https://www.theverge.com/2020/5/7/21250357/france-masks-public-transport-mandatory-ai-surveillance-camera-software</a></td>
</tr>
<tr>
<td>S.No.</td>
<td>Detail</td>
<td>Agency</td>
<td>Web link</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>47.</td>
<td>StopCovid: the French contact-tracing app</td>
<td>INRIA</td>
<td><a href="https://www.dataprotectionreport.com/2020/05/stopcovid-the-french-contact-tracing-app/">https://www.dataprotectionreport.com/2020/05/stopcovid-the-french-contact-tracing-app/</a></td>
</tr>
<tr>
<td>51.</td>
<td>Global Telemedicine Implementation and Integration Within Health Systems to Fight the COVID-19 Pandemic: A Call to Action</td>
<td>Henri Mondor Hospital, Créteil and Inserm</td>
<td><a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7124951/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7124951/</a></td>
</tr>
</tbody>
</table>

**DIAGNOSTIC TEST, MEDICAL DEVICES AND ANTI-VIRAL COATINGS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Detail</th>
<th>Agency</th>
<th>Web link</th>
</tr>
</thead>
<tbody>
<tr>
<td>54.</td>
<td>bioMérieux has developed two molecular diagnostic tests for COVID-19 in less than 2 months and a third complementary test to the first two is now available. Two serological tests have been validated and will be available soon.</td>
<td>bioMérieux</td>
<td><a href="https://www.biomerieux.com/en/covid-19/biomx%20molecular%20diagnostic%20tests%20for%20COVID-19/">https://www.biomerieux.com/en/covid-19/biomx%20molecular%20diagnostic%20tests%20for%20COVID-19/</a></td>
</tr>
</tbody>
</table>
Industry Academia Research Development Programme (IARDP)

Deadline for the submission of collaborative and seminar proposals under IARDP has been extended to 31 July, 2020

CEFIPRA supports Industry centric collaborative research projects in a framework (2+2 Model) under IARDP. Proposals with at least one industrial partner either in France or in India and a research institute from the other country can also be considered with proper justification.

Expected Outcome
The proposals should have clear deliverables like demonstration of proof of concept & prototype building up to Technology Readiness Levels (TRL 4-5). The scope of work and responsibilities of each partner must be highlighted.

Eligibility Criteria for Industry Collaborator:
The Company or SME should have well established in-house R&D unit with a good track record of R&D achievements. They should be registered and operational for at least last three years. If a start-up is incubating in a recognized Technology Business Incubator/cluster may be exempted from the criteria of 3 years.

Eligibility Criteria for Academic Collaborator:
Permanent Position in an Indian or French university / R&D institution

Budget Support
• Support will be given up to Euro 200,000. Outstanding proposals may be considered outside this range as exceptional cases
• The industrial partners must invest 10 to 25 % of the project cost in cash in the project (MSME and startups are exempted).

For Indian/French institute collaborator
i. Manpower Head (JRF/RA/Post Doc in Indian side as per DST rate)-and PhD/Post Doc and Master Student in French side(Maximum 60,000 euro)
ii. Consumables & Contingency
iii. Travel (Encouraging students travel & budget is as per CEFIPRA rate)
iv. Minor equipment only to Indian Collaborator, having limit of maximum of 10% of total approved budget of the project (max. 20,000Euros)

For Indian/French small Industry (SME, MSME, Startup) collaborator
i. Manpower Head (Budget is as per CEFIPRA rate)
ii. Travel (As per CEFIPRA rate)

For detail information, please visit following link: cefipra.org/Industry_Academia.aspx

How to apply:
The collaborators must submit joint full proposal on web-online submission system of CEFIPRA www.cefipraonline.in