IRD CONNECT

INDUSTRIAL RESEARCH & DEVELOPMENT UNIT

NEWSLETTER : APRIL - JULY 2020

INDIAN INSTITUTE OF TECHNOLOGY DELHI

Contents

Message from the **DIRECTOR**

Dear Readers,

I welcome you to the first edition of the quarterly IIT Delhi Research & Development (IRD) Newsletter. Through this newsletter, our endeavour is to bring the R&D related developments at IIT Delhi to you. In recent years, the number of sponsored R&D projects and funds attracted by IIT Delhi have increased manifold. The first issue of this newsletter is coming at a time when globally, COVID-19 has emerged as the greatest challenge before humankind in this century. As a leading institute in various areas of scientific and technological R&D in India, IIT Delhi has taken up the challenge head-on. Our Principal Investigators/Faculty and research teams have worked hard and, in a short time span, have delivered successful products and technologies to combat the dreaded pandemic. Some of the noteworthy sponsored R&D projects that have given positive outcomes are – development of a SARS CoV2 detection kit, PPEs such as Face Masks and Coverall, web-based dashboard PRACRITI, low-cost ventilator design, vaccine development, Ashwagandha and propolis, Tea (Camellia sinensis), and Haritaki plant-based COVID-19 drug development. Some start-ups incubated at the institute have also started the production of some of these products. Hon'ble Minister of Education Dr. Ramesh Pokhriyal 'Nishank' wholeheartedly praised the efforts made by IIT Delhi researchers at multiple platforms.

Besides COVID related R&D efforts, our faculty members were successful in attracting grants for several prestigious and high-value R&D Projects such as – Technology Innovation Hub on Cobotics from Department of Science & Technology(DST), Advance Data Management Systems project from National Highways Authority of India(NHAI), Strengthening the Food Supply Chain in India using Operations research under United Nations World Food Programme (UNWFP) among many others. You will find more details about the current research efforts and projects in this issue. We have taken multiple steps to boost interdisciplinary research culture on the campus in addition to encouraging faculty and students to collaborate with industry. We are seeing some of these efforts bearing fruit now.

I hope the newsletter will be informative for the R&D community in India and abroad. Happy reading.

Best Wishes
Professor V.Ramgopal Rao

Welcome Note

Prof. Sunil Kumar Khare
Dean (R&D)

Prof. Sukumar Mishra
Associate Dean (R&D)

"It is not unreasonable that we grapple with problems. But there are tens of thousands of years in the future. Our responsibility is to do what we can, learn what we can, improve the solutions, and pass them on." - Richard P. Feynman

Research and Development at IIT Delhi strives to transform the future by harbouring innovation and by providing technological solutions. IRD Connect, the first of its kind newsletter published by IRD unit, is being launched to connect key academic stakeholders - research groups, principal investigators, faculty members, research scholars, and postdoctoral fellows across IIT Delhi and other collaborating institutes.

Due to the COVID-19 pandemic, putting together the first edition of IRD Connect has been an arduous task & we hope to make the subsequent publications more comprehensive and fruitful.

Here's wishing our research community a safe and healthy year ahead!

Dean (R&D)

Major Initiatives of the IRD Unit

Technology Innovation Hubs (TIH) on Cobotics

IIT Delhi has been identified as one of the major Technology Innovation Hubs on Cobotics as conceptualized by the DST (Govt. of India). The programme is funded at the tune of INR 125 Cr for five years. Prof. Subir Kumar Saha will coordinate the hub with a team of interdisciplinary faculty members drawn from various departments.

New Centres of Excellence (CoEs)

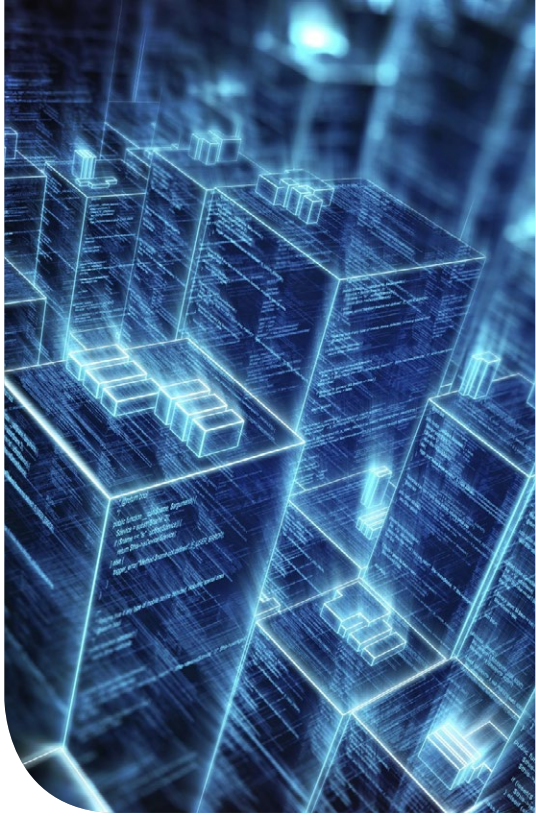
Centres of Excellence (CoEs) are set up to carry out focussed research towards creating excellence in knowledge and expertise. They are created for the advancement of cutting edge scientific research in a specialized domain, through funding from Government or Industrial partners. At present, fourteen Centres for Excellence (CoEs) are operational at the Institute supported by different agencies for state-of-the-art research in several areas such as Defence research, space technologies, clean air, climate change, waste to wealth, renewable power, biopharmaceuticals, 5G, robotics, artificial intelligence, and sustainable infrastructure.

In the current period, two new CoEs have been initiated:

i. Open Health Systems Laboratory (OHSL, USA) CoE on Computational and Biomedical Sciences

Institute has entered into an agreement with Open Health Systems Laboratory (OHSL), USA to set up an International Centre of Excellence (CoE) on Computational and Biomedical Sciences with initial funding of INR 10 Cr from the OHSL, to build a global team science consortium by leveraging the best of biomedical informatics to address critical questions of biomedical sciences. The major areas that will be addressed are the integration of Ayurveda and Western medical sciences for cancer biology and therapy, along with reconfigurable computing, systems biology approaches for cancer drug development and discovery.

ii. NHAI CoE in advanced Data Management Systems for Highways (ADMS-Highways)

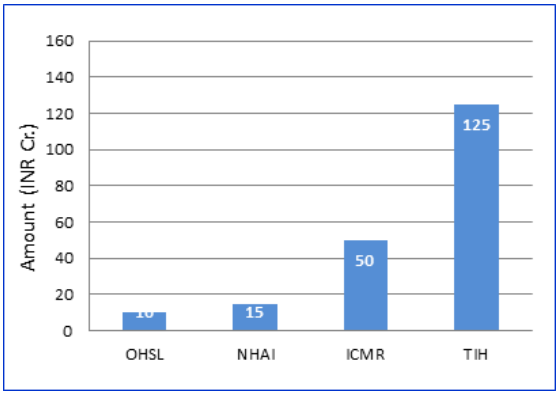


The National Highways Authority of India (NHAI) partnered with IIT Delhi for improving the road infrastructure ecosystem. To achieve these goals, NHAI has provided funding for setting up of a Centre for Excellence on advanced Data Management Systems for Highways at the tune of INR 10 Cr. The CoE will focus on advance analytics, modeling, simulations, and predictions based on Artificial Intelligence (AI) and Machine Learning (ML) on project management workflows & alerts, possible litigations & disputes, traffic & tolling revenue growth, road safety & better incident management and other such issues decided by NHAI & IIT, using massive data from NHAI Data Lake. This CoE also proposes to work on four different research areas such as i) Network Traffic Demand and Incident Management, ii) Highway Safety, iii) Highway pavement management system, and iv) Project Management. The CoE will be Coordinated by Prof. Geetam Tiwari and a team of faculty members from the Transportation Research and Civil Engineering department.

iii. ICMR CoE in Medical Devices

IIT Delhi, in collaboration with ICMR, has initiated a Centre of Excellence (CoE) on Medical Devices to accelerate innovative medical technologies and products. The primary focus of the CoE is to establish a single-point facility that can help translate concepts to products by developing a design, limited production, and testing facility (as per CE/ ISO certification). The CoE will work in close tandem with the Central Drugs Standard Control Organisation (CDSCO) to develop quality standards and facilitate regulatory approvals. This would lead to an increase in the current domestic manufacturing of medical devices and reduce import dependency. Moreover, it will create a pipeline of advanced technologies and products in line with the Aatmanirbhar Bharat initiative. ICMR has funded INR 50 Cr for setting it up. The CoE will be coordinated by Profs. Dinesh Kalyansundaram and Ravi Krishnan Elangovan from CBME and DBEB, respectively.

CoEs at IIT Delhi (April-July 2020)



Strategic partnership with the **United Nations World Food Programme**

The UNWFP and Indian Institute of Technology (IIT) Delhi signed an MoU to develop innovative solutions for enhancing the efficiency and effectiveness of the Government's food safety nets through operations research. The overall aim of this partnership is to create sustainable models that can be replicated across the country, the region, and beyond.

The UNWPF further sponsored a major research programme on advanced analytics and operations research to develop practical solutions that support long term strategic planning of procurement, storage, and movement of food grains by agencies such as the Food Corporation of India (FCI), vis-à-vis creating cost-effective supply chain networks for the distribution of these food grains under the Targeted Public Distribution System. Prof. Nomesh Bolia, Department of Mechanical Engineering, will coordinate the programme.

Webinar series on R&D activities at IIT Delhi

IRD initiated a monthly webinar series to keep the ball rolling during the COVID period with the help of Prof. Amit Gupta and the ETSC team. This programme was immensely successful in raising awareness as well as making the common people familiar with several IITD initiatives against the disease.

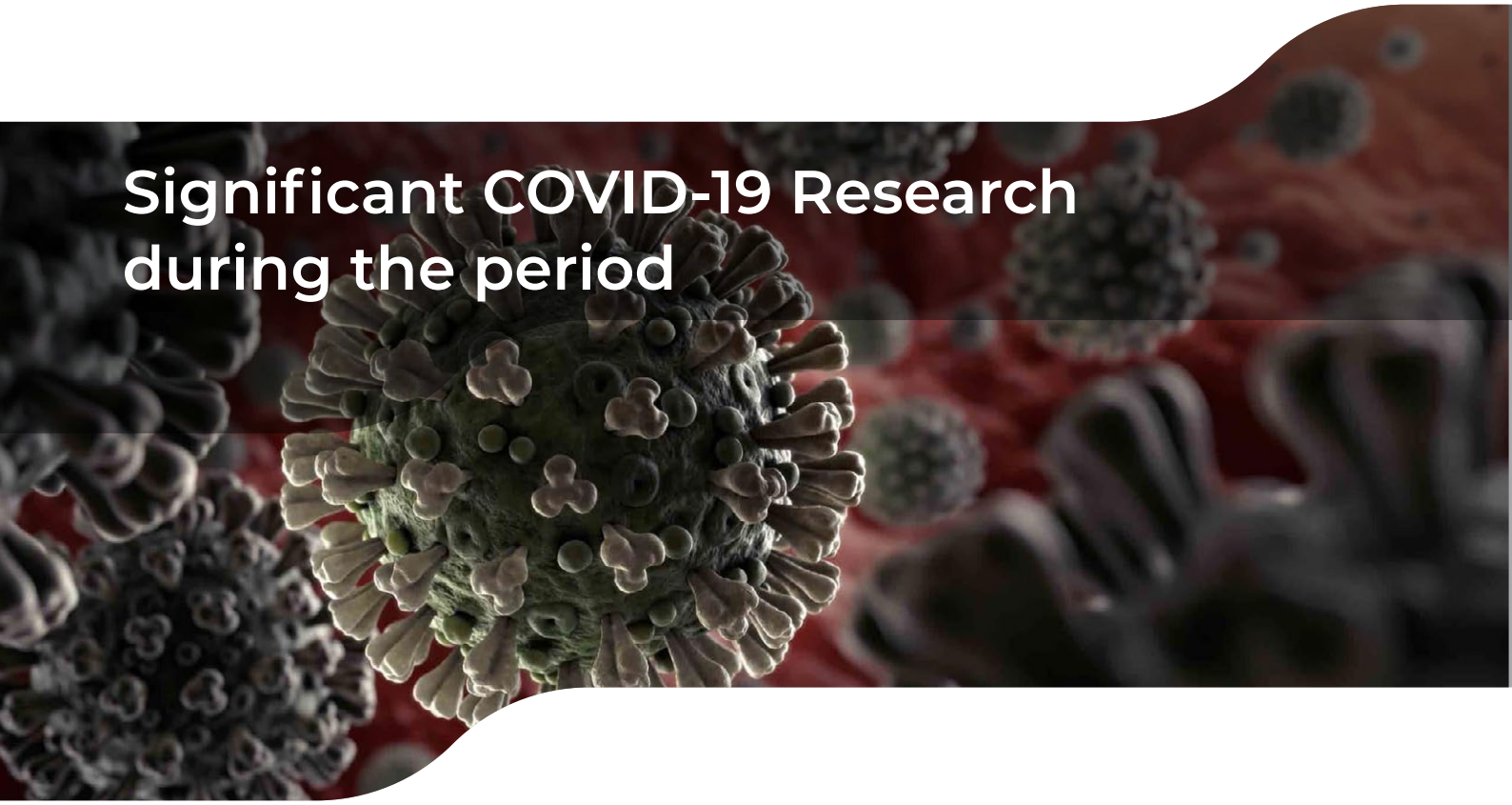
The following webinars were delivered and have been uploaded on institute website:

i. Diagnosis of SARS-CoV-2: A probe-free RT-PCR assay - Delivered by Dr. Vivekanandan Perumal, KSBS, May 2020.

ii. Kawach mask - A service to the nation (making India proud) - Delivered by Dr. Bipin Kumar, Dept. of Textile and Fibre Engineering, June 2020.

iii. PRACRITI – A Web-based Dashboard for Prediction of Corona Transmission in India - Delivered by Prof. N. M. Anoop Krishnan, Department of Civil Engineering & Department of Materials Science and Engineering, July 2020.

Significant COVID-19 Research during the period



While most of the research activities experienced a slowdown due to the national lockdown, research on solutions for COVID took a front seat to solve the unprecedented threat faced by humankind. The menace is as persistent as the tricky nature of nCoV itself. Concrete global efforts led to a precise understanding of viral genome and proteins and the development of many efficient test protocols. However, desired target/inhibitor molecules against its proteases, especially 3CL and vaccine development, still elude. The silver lining has been in terms of many grassroots level innovations and technologies, which helped to sustain the efforts viz. affordable ventilators, PPEs, and contactless sanitizers for the mass population. AI-based tools further helped the predictions. In the above scenario, efforts by IITD faculty are highly applaudable. Some of the significant research outcomes are highlighted at an exclusive webpage for COVID related research@IITD (https://home.iitd.ac.in/covid19-response.php) and YUKTI a MHRD portal http://13.71.2.227:8082/Research.aspx.

Corosure, COVID-19 Diagnostic Kit developed by IIT Delhi is a step towards Prime Minister Shri Narendra Modi's vision of a self-reliant India (Atmanirbhar Bharat).

IIT Delhi became the first academic institution in India to obtain the ICMR and DCGI approval for a real-time PCR-based and probe free diagnostic assay. Union Human Resource Development Minister, Shri Ramesh Pokhriyal 'Nishank' e-launched this affordable RT-PCR based COVID-19 diagnostic kit named as COROSURE, on July 15, 2020. The Minister appreciated Prof. Vivekanandan Perumal and his research team of IIT Delhi for the development of the COVID-19 diagnostic kit.

Anti-viral activity of Tea (*Camellia sinensis*) and Haritaki (*Terminalia chebula*)

A team of researchers led by Prof. Ashok Kumar Patel from KSBS and Dr. Manju Singh (Ayurvedic physician at Morarji Desai National Institute of Yoga, New Delhi, screened about 51 medicinal plants on 3CL Proprotease of the virus, which is necessary for the processing of the viral polyproteins. The experimental findings showed that aqueous extracts from Tea (Black and Green Tea) as well as Haritaki have potential anti-viral activity via in-vitro inhibition of the main protease of the virus 3CL pro. The group proved that Gallotannin (or Tannic acid) is majorly involved in inhibiting the 3CL Proviral protease. The research work was recently published in Phytotherapy Research (Article DOI: 10.1002/ptr.6802).

The findings suggest the possibility of Gallotannin to emerge as a potential therapeutic candidate against SARS-CoV-2 , subject to in vivo validation.

Ashwagandha takes the lead to be the mother nature's COVID-19 warrior

DAILAB (DBT-AIST International Laboratory for Advanced Biomedicine) teams @IIT Delhi and @AIST Japan, discovered that Withanone (Wi-N), a natural compound derived from Ashwagandha (Withania somnifera) and Caffeic Acid Phenethyl Ester (CAPE), an active ingredient of New Zealand propolis, have the potential to interact with and block the activity of viral protein M-pro required for its replication. The recent initiative of the Indian Government in forming an Interdisciplinary Task Force [joint initiative of Ministry of AYUSH, Ministry of Health and Family Welfare (MoHFW), the Ministry of Science & Technology through Council of Scientific & Industrial Research (CSIR) with Indian Council of Medical Research (ICMR)] to launch Ashwagandha's clinical research studies related to SARS-CoV-2 and the COVID-19 disease, provides a hint at its direct anti-viral activities.

The research team was led by Prof. D. Sundar from IITD and Dr. Renu Wadhwa and Dr. Sunil Kaul (Senior Research Scientist, AIST-INDIA DAILAB) from the National Institute of Advanced Industrial Science & Technology (AIST), Tsukuba, Japan.

Covid-19 dashboard PRACRITI

Prof. N.M.Anoop Krishnan, Department of Civil engineering and his team, have developed a web-based dashboard for predicting the spread of Covid-19 in India. The mobile-friendly dashboard, named as PRACRITI (Prediction and Assessment of CoRona Infections and Transmission in India), gives detailed state-wise and district-wise predictions of Covid-19 cases in India. The projections are provided for a three-week period, which are updated weekly.

Affordable PPE Coverall

Prof. SM Ishtiaque, Department of Textile and Fibre Engineering, IIT Delhi and his student, Dr. Biswa Ranjan Das, Scientist 'D' & Assistant Director, DMSRDE (DRDO), Kanpur, have developed an advanced version of PPE coverall, which meets the criteria specified by the Ministry of Health and Family Welfare, Government of India.

COVID19: Automated Touchless Dispenser for Sanitizer

A touchless automated sanitizer dispenser has been developed by Prof. Monika Aggarwal, CARE, which can be seen functional at the Institute.

Start-ups

The new start-ups have emerged as the face of the Institute for the development, production, and distributions of PPE, face masks, and other COVID related products. The major among these are (i) ETEX Healthcare Private Ltd. led by Prof. Bipin Kumar, Dept. of Textile and Fibre Engineering for production of 3 Ply Mask with 98% BFE (KAWACH Mask) and Laminated Knitted based Coveralls/Gowns (ii) NanoSafe Solutions Pvt. Ltd led by Prof. Mangla Joshi, Dept. of Textile and Fibre Engineering for the development of reusable antimicrobial protective fabrics as a control measure for emerging infectious diseases (iii) Nanoclean Global Pvt. Ltd led by Prof. Ashwini Agarwal and Prof. Manjeet Jassal, Dept. of Textile and Fibre Engineering for the development of reusable antimicrobial protective fabrics as a control measure for emerging infectious diseases and production of good three-layered quality surgical masks for hospitals & health workers (iv) Fabiosys Innovations led by Prof. Samrat Mukhopdhyay, Dept.of Textile and Fibre Engineering for development of antimicrobial fabric for protection against hospital-acquired infection (v) Clensta Corporation, led by Prof. Anurag S. Rathore, Department of Chemical Engineering for the development of hand sanitizer.

Sponsored Research projects

Externally Sponsored Research & Consultancy projects

Sponsored Projects & Consultancy Work (April 1 – July 27, 2020)

Month	No. of Projects Created	Sanctioned Funds (INR Lacs)
April 2020	17	1329.30
May 2020	40	1859.56
June 2020	30	627.99
July 2020	28	511.13
Total	**115**	**4327.98**

High-Value Sponsored Projects

High-Value Sponsored Projects from 1-4-2020 to 20-7-2020
(With Value INR 75 Lacs and above)

S. No.	Project No.	Title	Sponsoring Agency	Sanctioned Funds (INR. Lacs)	PI	Department
1.	RP03931G	ASEAN Ph.D. Fellowship Programme Secretariat	Ministry of Human Resource & Development	927.80	Prof. Nomesh Bolia	Dept. of Mechanical Engineering
2.	RP03936G	Neurocomputing and Cognitive Intelligence	Ministry of Electronics and Information Technology	231.31	Prof. Tapan Kumar Gandhi	Dept. of Electrical Engineering
3.	RP03947G	Spin-orbit torque driven domain wall synapse based hardware neural network	Scheme for Transformational and Advanced Research in Sciences	99.64	Prof. Debanjan Bhowmik	Dept. of Electrical Engineering
4.	RP03949G	Development of Automated Basti Yantra- A comprehensive tool for Therapeutic Induction of Enema	Central Council for Research in Ayurveda	83.21	Prof. Sumer Singh	Dept. of Design
5.	RP03956G	Design and Development of an efficient biomass cookstove	Department of Science & Technology	76.78	Prof. Priyanka Kaushal	Centre for Rural Development Technology
6.	RP03944G	Efficient Food Grain Supply Chain for FCI and Uttarakhand	United Nations World Food Programme,	76.32	Prof. Nomesh Bolia	Dept. of Mechanical Engineering
7.	RP03911G	MEMS RF Power amplifier	Science and Engi-neering Research Board	75.99	Prof. Bhaskar Mitra	Dept. of Electrical Engineering
8.	RP03946G	Sustainable Processing of Agro-residual Waste to Produce Acoustic Materials and Biorenewable Chemicals using Green Solvents	Department of Science & Technology	75.87	Prof. Shahab Fatima	CART, (formerly known as ITMMEC) .

IRD Sponsored projects

i. Faculty Interdisciplinary Research Project (FIRP)
The short term FIRP programme was launched to support the faculty members as seed support for their COVID related research. Five FIRP-COVID projects were funded based on the potential leads.
On similar lines, the call was made to invite project proposals to work on the Locust problem; two FIRP- Locust challenges were funded based on the viability of the proposed solutions.
ii. Multi-Institutional Faculty Interdisciplinary Research Project (MFIRP)
-Under the IITD-National Institute of Immunology MoU, researchers from IITD were allowed to use the state of art animal house facility of NII. Two collaborative MFIRP on COVID research between faculty from IITD and Scientists from NII have been funded jointly by both the institutions.
-Under the NCTU Taiwan and IITD research collaboration, eighteen projects between faculty from IITD and NCTU in various interdisciplinary areas have been funded jointly by both the institutions for two years.

Students Related Activities

i. Student I4 (Ideation at Isolation and Implementation at Institute) Challenge
This initiative was launched for IITD students amid the suspension of academic activities due to the COVID-19 lockdown.
IITD students/student groups across various programs and disciplines were to find modern solutions to challenges in topical areas of innovation, design & society posed by IITD faculty members.
Twenty-eight Student I4 Challenges were floated for students to participate over two months from April to May 2020. Seventy-one responses have been received and being evaluated by the respective faculty. The winner(s) will be rewarded with attractive cash prizes.

ii. University College of London (UK) funded Summer School for five IITD doctoral students
Under IITD- UCL MoU, five IITD doctoral students were supported to participate in UCL Medical Image Computing Summer School (MedICSS) from 6 –10 July 2020.

Relentless contribution of the IRD staff

IRD was functional in online mode during the entire lockdown period of March-June. This enabled the timely release of salaries for project students, staff, and other employees in addition to regular forwarding, initiation, and operation of projects under challenging circumstances. The sincerity and hard work of the IRD staff are highly appreciated.

“Research is Creating New Knowledge”

Neil Armstrong

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R&D, IIT Delhi

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