SCIENCE & TECHNOLOGY EFFORTS IN INDIA ON COVID-19

SPECIAL ISSUE

Initiatives from the Department of Science & Technology (DST)

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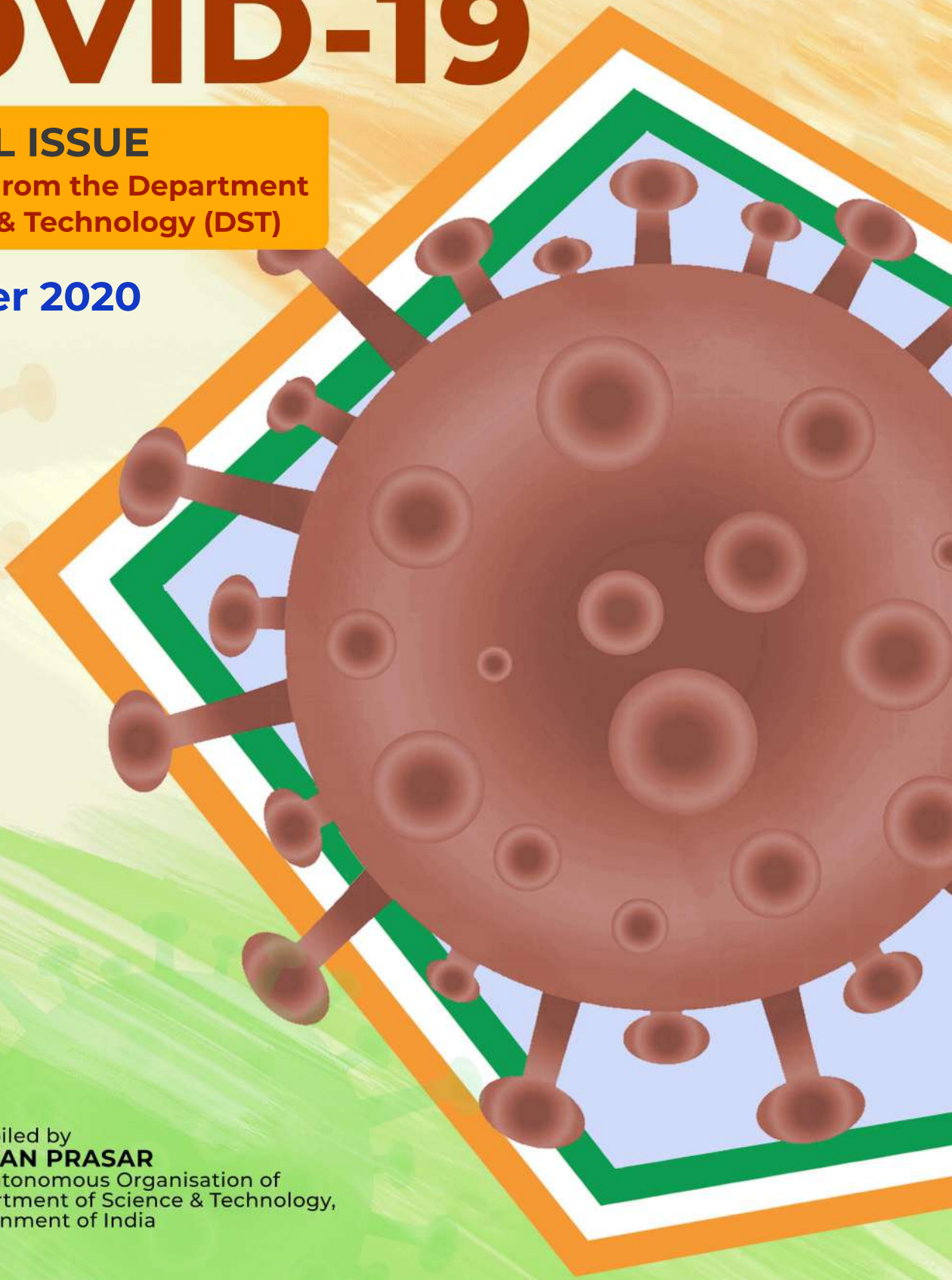

Compiled by
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Department of Science & Technology,
Government of India

सबका साथ, सबका विकास, सबका विश्वास
Sabka Saath, Sabka Vikas, Sabka Vishwas

सत्यमेव जयते

FOREWORD

डॉ हर्ष वर्धन
Dr Harsh Vardhan

स्वास्थ्य एवं परिवार कल्याण, विज्ञान और प्रौद्योगिकी व पृथ्वी विज्ञान मंत्री, भारत सरकार

Union Minister for Health & Family Welfare, Science & Technology and Earth Sciences Government of India

The 2019 Novel Coronavirus (SARS-CoV-2) has spread rapidly throughout the world and has assumed the proportion of a Pandemic. Given the lack of an efficacious vaccine as well as non-availability of suitable chemotherapeutic interventions, mankind is experiencing an unprecedented existential crisis.

2. The Ministry of Science and Technology and the Ministry of Health & Family Welfare, with their various departments, are contributing in various ways towards the national R&D efforts for developing solutions to combat COVID-19. The Department of Science & Technology under the Ministry has launched a nationwide exercise to map and boost development of COVID-19 solutions with R&D, seed capital and scale-up support. All academic and research institutions are being reoriented to focus on the development of diagnostics, vaccines, antivirals, disease models and other R&D to enable a cure for this dreadful disease. Around 15 labs of Council of Scientific & Industrial Research (CSIR), under the Department of Scientific & Industrial Research, across the country are working in close partnership with major private sector Industries, PSUs, MSMEs and other Government departments to develop solutions for COVID-19. The Department of Biotechnology (DBT) under the Ministry has also formed a consortium to support the development of Medical equipment, Diagnostics, Therapeutics, Drugs and Vaccines to meet the Healthcare Challenges. Indian Council of Medical Research (ICMR), under the Ministry of Health & Family Welfare has already isolated the virus strain successfully, which is a first step towards vaccine research. Similarly, various other organizations under Ministry of Human Resource & Development, Ministry of Defence, Ministry of Chemicals & Fertilizers, etc. are also contributing substantively to our R&D efforts. The private sector has also come forward in a big way to supplement these efforts.

3. With a view to spreading awareness about the S&T efforts of the Government of India as well as private sector in finding solutions for COVID-19, Vigyan Prasar - an autonomous institution under Ministry of Science & Technology and engaged in large-scale science communication and popularization activities - has compiled all initiatives being undertaken in this field.

4. This document "Science & Technology Efforts on COVID-19 in India" shall serve as a ready-reckoner for policy makers, scientists, researchers, scholars and other stakeholders who might be interested in understanding and keeping themselves abreast with the latest S&T efforts being made to develop solutions to combat COVID19.

(Dr. Harsh Vardhan)

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PREFACE

The COVID-19 pandemic is unleashing a human development crisis. On some dimensions of social development, conditions today are equivalent to levels of deprivation. The situation is hitting hard on all constitutive elements of it: economy, health and education. Most of the current strategies to reduce the risk of SARS-CoV-2 transmission are based on controlling interactions between humans, including case isolation, tracking patient contacts and screening passengers crossing borders. The pandemic has posed one of the biggest challenges to the entire humanity. In the wake of its outbreak, our lives have changed in ways we had never imagined before. In these critical times, access to authentic information is of paramount importance. Vigyan Prasar (VP) has been covering the pandemic since the early days with the science communication perspective, ensuring that science and safety are the primary focus.

Taking the journey further, this edition of the newsletter extensively covers initiative taken and facilitated by the Department of Science & Technology (DST), Government of India. Several DST autonomous organisations have come up with numerous solutions for various aspects of the multidimensional COVID pandemic within a month and that some of these solutions have emerged in collaboration with private companies and startups. So clearly, DST has been catalysing a change in the process of doing science, and the crisis has come as a ground testing of that change. The edition enumerates the efforts and initiatives for the usage of scientific fraternity as the target audience and the general public as a typical audience.

The pandemic has created pressures on the business environment, necessitating the adoption of technology and digitalisation. Companies across sectors are accelerating investments in Digital Technologies to meet business requirements. The pandemic was superimposed on unresolved tensions between people and technology, between people and the planet, between the haves and the have-nots. These tensions were already shaping a new dimension of inequalities on enhanced capabilities and the unique necessities of the 21st century. But the response to the crisis carries the potential to shape strategies on how those tensions can be addressed and how inequalities in human development are reduced.

We are still in the middle of the crisis. However, the impact emerging out of the pandemic is shaping the new world order with local solutions to the challenges. This edition of the newsletter, at a macro level, provides the analysis of STI efforts of DST toward the mitigation of the pandemic and aims to create an enabling ecosystem for effective science communication.

Vigyan Prasar
New Delhi

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The e-newsletter is being published on a regular basis by collating all the inputs received till the preceding day of the release.

The older issues of e-newsletter are available in the Archival Section at https://vigyanprasar.gov.in/covid19-newsletter

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

DEPARTMENT OF SCIENCE AND TECHNOLOGY (DST)

1. Background

The worldwide pandemic of coronavirus disease (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). India has been equally affected like many other countries of the world. The transmission dynamics of SARS-CoV-2 have allowed it to spread rapidly across the world bringing an epidemic-like situation. Given the lack of availability of suitable therapeutic interventions and an efficacious vaccine, the global population has been hit hard with utmost vulnerability to the coronavirus infections. Since the outbreak of the pandemic, Government of India, through its various Science and Technology-based organisations and institutions, undertook fast track programmes to identify the gaps in the diagnosis, treatment, prevention and other aspects of disease aetiology and transmission of COVID-19 through various stakeholders across the country for enhancing research and development-related activities to battle the pandemic out.

2. Policy-level interventions taken up by the DST

The Department of Science & Technology and its various Autonomous Institutions made some significant efforts to address R&D and innovation-related challenges arising out of COVID-19 pandemic. Based on rapid planning, the first sets of concrete actions were underway starting from March 19, 2020.

The actions were seeded with speed and scale at several fronts, which included:

i. A comprehensive mapping of DST's entire start-up ecosystem to identify and support the relevant technology solutions ready for scaleup; over 600 relevant start-ups mapped; around 60 start-ups being supported.

ii. A special call to support industries that have an appropriate and proven product or technology to commercialize or scaleup further;

iii. A call to support projects from academia and R&D labs on the basic science of COVID-19 including modelling, properties of the virus and its impact, novel solutions, etc.;

iv. A special call on scientifically identifying relevant yoga and meditation practices for immunity boosting, respiratory toning and stress reduction;

v. Support for a network of over 30 mid and large size NGOs for dissemination of information, training and mask/disinfectant distribution;

vi. Activation of Survey of India in relevant digital mapping solutions;

vii. Formation and support to a group across several IITs and AI start-ups to find Artificial Intelligence solutions to COVID-19 diagnostics and predictions;

viii. Linked with technology industry such as IBM, NVIDIA etc. who have agreed to provide resources such as supercomputing time and software stacks pro bono for COVID-19 research;

ix. Communication: Made several dozens of programmes on COVID-19 for India Science Internet TV channel and widely disseminated weekly reports on all the initiatives of MoST on COVID-19;

x. Activation of relevant DST autonomous institutions in providing solutions - a particularly successful institute has been Sree Chitra Tirunal Institute of Medical Science and Technology which has already come up with over 10 effective products, several of which are of a breakthrough nature and are being commercialized rapidly.

xi. Formation of a National Task Force with over 20 leading scientists for formulating a Super Model for predicting the spread of the pandemic. The model should be robust and trustworthy to allow confidence in its predictions for decision making. Timeline is end of July.

xii. RT-PCR Testing Centres operational in over 10 scientific institutions based on the research facilities established there previously by the DST, including 5 autonomous institutions of DST. A comprehensive one-week course on molecular diagnostics for scientists and technicians is being offered at JNCASR, Bangalore (a DST institution).

3. Technological interventions initiated by the DST and its Institutions to address COVID-19 challenges

As part of initiatives of some of the DST's Divisions and Autonomous Institutions, a number of activities and actions were initiated on developing technological solutions to address COVID-19 challenges. These include Diagnostics, Ventilators, PPE, disinfectants, plasma therapy & vaccine development, etc. Several R&D projects were also launched. A summary of these initiatives are enumerated in the following paragraphs.

DIAGNOSTIC KITS RELATED

A) SCTIMST develops a diagnostic test kit that confirms COVID-19 in 10 minutes

- Confirmatory diagnostic test detects the N Gene of SARS-CoV-2 using reverse transcriptase loop-mediated amplification of viral nucleic acid (RT-LAMP) - one of world's first few;
- One-step detection in 10 minutes and the sample-to-result time (from RNA extraction in swab to RT LAMP detection time) is less than 2 hours;
- A total of 30 samples can be tested in a single batch in a single machine;
- Testing facility can be easily set up even in the laboratories of district hospitals with limited facilities and trained laboratory technicians.

B) Sree Chitra Tirunal Institute develops magnetic nanoparticle-based RNA extraction kit for PCR and LAMP tests for COVID-19

- Chitra Magna, an innovative RNA extraction kit, has been developed by Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), as an innovative technology for isolating RNA from swabs for COVID-19 tests.
- SARS-CoV-2, the causative virus of COVID-19 pandemic, is an RNA virus -- a long, single-stranded polymeric substance present in all living cells that carries the genetic information of the organism necessary for life.
- One of the critical steps in detecting this virus is by confirming the presence of the RNA of the virus in the sample taken from the throat or nose. The sample collected is transported under specified conditions in a viral transport medium to the testing laboratory.

C) JNCASR launched indigenous fluorescence probes and PCR

- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), in partnership with VNIR Biotechnologies Private Limited, a start-up incubated by JNCASR, launched indigenous fluorescence probes and PCR (Polymerase Chain Reaction) mix for RT-PCR (Reverse transcription polymerase chain reaction) detection which are molecular probes used in COVID-19 test kits.

D) DST-funded start-up develops kits for testing asymptomatic COVID-19 infections & gears up for vaccine production

- DST provided support to Seagull BioSolutions, Pune, a start-up working on new biological technologies to undertake the development of Active Virosome (AV)-Vaccine and Immunodiagnostic kits for tackling COVID-19 emergency.
- Active Virosome Technology (AVT) is useful for the production of vaccines and immunotherapeutic agents. The AVT platform helps will be used to develop a novel vaccine for the prevention of COVID-19 infection and also immunodiagnostic ELISA kits for COVID-19.

E) DST funds Pune healthcare start-up for rapid detection of COVID-19

- DST has funded Module Innovations, a Pune-based healthcare start-up working on the point-of-care diagnostics to develop a test kit for detecting COVID-19 within 10 to 15 minutes.
- Using the proven concept from its flagship product 'USense', The start-up is now developing nCoVSENSEs (TM) which is a rapid test device for detection of antibodies that have been generated against the COVID-19 in the human body

F) Rapid diagnostic kit being developed by Pune based start-up for COVID-19 screening

- DST has funded FastSense Diagnostics, a start-up to develop a rapid diagnostic kit for the screening of COVID-19.
- The company plans to roll out a modified Polymerase chain reaction (PCR)-based detection kit for confirmatory analysis in lesser time compared to existing detection methods (approximately 50 samples can be tested in an hour).

- A portable chip-based module for rapid screening of target population based on the on-chip sensing technology has been developed that would provide on-the-spot results in less than 15 minutes per sample.

G) TDB approves support for indigenous company for ramping up production of COVID-19 diagnostic kits

- TDB has approved financial support to MyLab Discovery Solutions, Pune for ramping up production of COVID-19 diagnostic kits.
- Mylab Discovery Solutions is the first indigenous company to develop real-time PCR-based molecular diagnostic kit that screens and detects COVID-19 from samples of people who display flu-like symptoms.
- The company will ramp up the production of the kits through automation of the facility from current manual process, thereby increasing its current capacity from 30000 tests per day to one lakh test per day.

H) Birbal Sahni Institute of Palaeosciences (BSIP) sets up a COVID-19 Testing Lab

- Birbal Sahni Institute of Palaeosciences (BSIP) joined hands with the Government of Uttar Pradesh to set up laboratory testing of COVID-19 using ancient DNA BSL-2A laboratory of the Institute. More than 12000 samples have been tested, out of which about 400+ samples have been reported positive for SARS-CoV-2.

G) Institute of Advanced Study in Science and Technology (IASST), Guwahati sets up a COVID-19 testing and research laboratory

- Institute of Advanced Study in Science and Technology (IASST), Guwahati, in coordination with Guwahati Medical College & Hospital (GMCH) and National Health Mission has set up a COVID-19 testing and research laboratory. Most of the equipment, including RT-PCR, biosafety cabinets, deep refrigerators, refrigerated centrifuge, laminar flow, autoclave, etc. are arranged from IASST. Another RT-PCR has also been provided by the IIT, Guwahati, for the laboratory.

H) Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), sets up a state-of-the-art COVID Diagnostic Training Centre

- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), established a state-of-the-art COVID Diagnostic Training Centre at its Jakkur campus to help build capacity for the national fight against COVID-19 pandemic. The first batch has undergone training from June 16 to 22, 2020, at COVID Training Facility, JNCASR.

VENTILATORS RELATED

A) DST-funded company to scale up device to enrich oxygen supply in air for the treatment of COVID-19 patients

- DST is scaling up membrane oxygenator equipment (MOE) that was developed to treat COVID-19 patients.
- It is supporting to Genrich Membranes, a spin-off company, based on proprietary technology

licensed from CSIR-NCL, Pune. Based on innovative, indigenous hollow-fibre membrane technology, the MOE enriches oxygen in the air up to 35% under pressure (4-7 bar, using oil-free compressor).

- ❖ The equipment consists of membrane cartridge, oil-free compressor, output flowmeter, humidifier bottle, nasal-cannula, and tubing and fittings.
- ❖ The device is safe, does not require trained human resources for its operation, needs minimum maintenance, is portable, compact, and with plug-and-play facility provides on-site, quick-start oxygen-enriched air.

B) SCTIMST ties up with Wipro 3D to manufacture automated ventilators to meet COVID-19 related crisis

- ❖ SCTIMST, an institute of national importance of the DST, tied up with Wipro 3D, Bengaluru to jointly build up a prototype of an emergency ventilator system based on Artificial Manual Breathing Unit (AMBU).
- ❖ The ventilators can help meet urgent requirements arising out of the COVID-19-related crisis that the country is facing.
- ❖ AMBU bag or a bag-valve-mask (BVM) is a hand-held device used to provide positive pressure ventilation to a patient who is either not breathing or who is breathing inadequately.

DISINFECTANTS RELATED

A) SCTIMST scientists develop disinfected barrier-examination booth for examining COVID-19 patients

- ❖ Scientists at SCTIMST, Thiruvananthapuram, an autonomous institute of the DST, have designed and developed a disinfected barrier-examination booth for examining COVID-19 patients.
- ❖ The innovative booth is closed like a telephone booth for examining and reviewing the patient without direct contact with the doctor to prevent transmission of infection.
- ❖ It is equipped with a lamp, table fan, rack, and Ultraviolet (UV) light.

B) SCTIMST scientists develop disinfection gateway & facemask disposal bin to fight COVID-19

- ❖ Scientists at Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram, an autonomous institute under the DST, have designed two technologies to fight COVID-19 pandemic.
- ❖ Chitra Disinfection Gateway is one of the two technology designed by SCTIMST scientists Jithin Krishan and Subash VV from the Division of Medical Instrumentation for the decontamination of people, one at a time. It is a portable system equipped with a system for generating Hydrogen peroxide mist and UV-based decontamination facility.

C) Technology by Pune-based Start-up incubatee of Scitech Park to disinfect Maharashtra hospitals in COVID-19 fight

- ❖ A technology developed under the NIDHI PRAYAS programme of DST by an incubatee company of Scitech Park, Pune has emerged as an effective solution for India's fight against COVID-19 by reducing the viral load of infected areas within a room significantly within an hour.

- Various globally renowned labs have scientifically tested its usefulness in killing disease-causing viruses and bacteria in different types of closed environments like houses, hospitals, schools, farms, industries, and so on.
- One hour of operation of Ion generator machine reduces viral load within a room by 99.7% depending on room size.

D) DST & DBT-funded start-up develops silver-based disinfectant to fight COVID-19 pandemic

- DST and DBT have jointly supported and funded Weinnovate Biosolutions, a Pune-based start-up, to develop a non-alcoholic aqueous-based colloidal silver solution uniquely made from its NanoAgCide technology for disinfecting hands and environmental surfaces.
- The newly developed disinfectant is non-inflammable and free of hazardous chemicals.
- It can work as an effective sanitizer to prevent the spread of the infection through contact, the prime method of transmission of the pandemic, thereby protecting health professionals and infected people.

E) UV disinfection trolley can effectively clean up hospital spaces to combat COVID-19

- International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous R&D Centre of the DST and University of Hyderabad (UoH) together, with the help of Mekins Industries Ltd. (MIL), have developed a UVC-based disinfection trolley to fight against COVID-19 by rapid cleaning of hospital environment.
- UV light in the range of wavelengths between 200 and 300 nm is capable of inactivating microorganisms, such as bacteria and viruses, thus disinfecting both air and solid surfaces. Often, chemical disinfectants are not enough to remove the bacteria and viruses found in hospitals and other contamination-prone environment. Rapid decontamination of the used patient-care beds and hospital rooms before admission of subsequent occupants is a major requirement in hospitals in view of the limited availability of beds. Coronavirus is sensitive to UVC light, as in the case of other viruses and bacteria.

F) ARCI develops UV-based baggage disinfection system

- Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, in partnership with Vehant Technologies, Noida developed KritiScan® UV Baggage Disinfection System. This is a compact UVC conveyor system which can efficiently disinfect the baggage passing through the conveyor within a few seconds and is suitable for use in airports, railway and bus stations, hotels, commercial and private establishments for rapid disinfection of the baggage. The disinfection process is dry and chemical-free.

G) SCTIMST develops UV-based face mask disposal bin technology

- A Chitra UV-based face mask disposal bin technology, named BIN-19, was developed jointly by the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram and VST Mobility Solutions, a Start-up based at Cochin. The IoT-based BIN-19 used for collecting and disinfecting used face mask, was formally launched by Ernakulam District Collector S. Suhas by installing a unit in his office, the administrative headquarters of the district.

PPE-MASKS, SANITIZERS, ETC. RELATED

A) Hand sanitizer prepared by ARCI provided to police personnel on duty during COVID-19 crisis

- ARCI, Hyderabad, an autonomous R&D Centre of the DST, has produced hand sanitizer as per the WHO standards and distributed it among police personnel in Hyderabad, students, and staff of the institution.
- A team of scientists, students, and staff voluntarily came forward and produced about 40 litres of sanitizer.

B) DST supported start-up to make natural, alcohol-free sanitizer to combat COVID-19

- DST provided support and funds to Green Pyramid Biotech (GPB), Pune, a company working on Food, Agriculture, and Bio-Technology for making sanitizer formulation developed by it.
- The Active Pharmaceutical Ingredient (API) is a biosurfactant that provides long-lasting protection against bacteria and viruses and can be an alternative to reduce the risk of infection significantly.
- The formulation can provide a convenient and effective way to clean hands and surfaces and is biodegradable, natural, and alcohol-free. In addition to sanitization it can be used to clean the wounds and prevents dryness and skin irritation.

C) Antiviral nano-coatings to be upscaled for making triple layer medical masks & N-95 respirator to combat COVID-19

- As part of Nano Mission programme, the DST approved support for upscaling an antiviral nano-coatings developed by IIT Delhi researchers for use as appropriate material for producing anti-COVID-19 Triple Layer Medical masks and N-95 respirator in large quantities.
- They will carry out the upscaling work in association with two industrial partners, Resil Chemicals Pvt Ltd. Bangalore and Nanoclean Global Pvt Ltd., New Delhi.
- Resil chemicals will provide N9 blue nanosilver. Nanoclean Global will provide face masks and PPE materials for the application of nanocoating and will help in the design and fabrication of samples at their facilities.

D) CeNS uses electrostatics of materials to develop Tribo E mask to protect healthy individuals from COVID-19

- A team of researchers at the Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, an autonomous institute of the DST, has come up with a recipe for making face masks, termed as Tribo E Mask, that can hold electric charges to restrict the entry of infections, but interestingly, without any external power.

PLASMA THERAPY AND VACCINE DEVELOPMENT RELATED

A) India deployed COVID-recovered patients' antibodies in plasma therapy trial

- India initiated clinical trials of a plasma treatment for critical COVID-19 patients, under the aegis of ICMR.

- Convalescent plasma therapy is a process in which blood plasma from a patient who has recovered from COVID-19 is infused into a critically ill patient so that specific antibodies present in the blood of recovered person can help fight the infection.
- Researchers called it a "promising rescue option" for severe COVID-19 patients but added that large randomised control trials are needed.
- The study appeared in the American journal, Proceedings of the National Academy of Sciences (PNAS). The trails become important as there is no tried and tested anti-viral drug or vaccine against the novel Coronavirus yet.

B) DST-funded start-up develops kits for testing asymptomatic COVID-19 infections & gears up for vaccine production

- DST provided support to Seagull BioSolutions, Pune, a start-up working on new biological technologies to undertake the development of Active Virosome (AV)-Vaccine and Immunodiagnostic kits for tackling COVID-19 emergency.
- Active Virosome Technology (AVT) is useful for the production of vaccines & immunotherapeutic agents. The AVT platform helps in developing a novel vaccine for the prevention of COVID-19 infection and also immunodiagnostic ELISA kits for COVID-19.

R&D & INNOVATION INITIATIVES ON COVID-19

A) Study to identify biomarkers to predict progression from non-severe to severe COVID-19 cases can help interventions

- SERB, a statutory body under the DST, will support the exploration of metabolomics alteration in COVID-19 infected patients by IIT Bombay in collaboration with some hospitals in Mumbai.
- The study will identify potential biomarker candidates to predict progression from non-severe to severe COVID-19 conditions.

B) Book chapter on the structure of the coronavirus by RRI

- The chapter includes morphological features as well as structural details with references to structure-function correlation and drug targeting aspects.
- It will be part of a book on the coronavirus pandemic, its control and treatment as well as its social, political and economic effects on India and the world.

C) Mathematical models for spread of COVID-19: An explanation for non-scientists

- COVID-19 pandemic has exposed us to the necessity of predictions through mathematical models.
- The predictions from these models sometimes differ widely, and it may be confusing to citizens and political leaders, who make important decisions based on predictions.
- Theorists at Raman Research Institute (RRI) are writing a popular article titled: "Mathematical models for spread of COVID-19: An explanation for non-scientists" to help clear the confusion and be socially useful

D) A predictive model by JNCASR can help prepare for medical needs for COVID-19

- A team of researchers from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under the DST, along with collaborator from IISc Bengaluru have developed a heuristic predictive model for COVID-19 that provides short-term predictions about the evolution of the disease and the medical needs that are generated as a consequence.

E) DST approves funding for developing a gel for nasal passage as prevention for COVID-19

- DST has taken the initiative to develop a gel that can be applied to the nasal passage, which is a significant entry point of the coronavirus.
- Department of Biosciences and Bioengineering, IIT Bombay, has been selected to develop the solution.
- This solution is not only expected to protect the safety of healthcare professionals but also can lead to a reduction in community transmission of COVID-19.

F) DST sets up Task Force for mapping of technologies by Start-Ups on COVID-19

- DST has set up a COVID-19 Task Force for mapping of technologies from R&D labs, academic institutions, start-ups, and MSMEs to fund nearly market-ready solutions in diagnostics, testing, healthcare delivery solutions, equipment supplies.
- Some of these solutions include masks and other protective gear, sanitizers, affordable kits for screening, ventilators and oxygenators, data analytics for tracking, monitoring, and controlling the spread of outbreak through AI and IOT-based solutions.

G) DST launches nationwide exercise to map & boost COVID-19 solutions with R&D, SEED & scale-up support

- DST has set up a 'COVID-19 Task Force' for mapping of technologies from R&D labs, academic institutions, start-ups and MSMEs.
- The capacity mapping group has representatives from DST, DBT, ICMR, MeitY, CSIR, AIM, MSME, Start-up India and AICTE.
- The aim is to identify the most promising start-ups that are close to scaleup, who may need financial or other help or connects based on its projected demand to rapidly scaleup.

H) Coating developed by JNCASR may prevent transmission of infection

- JNCASR, Bengaluru, an autonomous institution under the DST, developed a one-step curable anti-microbial coating which, when coated on different surfaces such as textile, plastic and so on could kill range of virus types including COVID 19.
- The molecules developed can chemically cross-link with different surfaces upon UV irradiation.
- Upon the formation of the coating, it has been shown to permeabilize the membranes of pathogens (i.e., bacteria) leading to their inactivation.

I) DST-SERB announces first set of approved projects to combat COVID-19 & related respiratory infections

- DST-SERB announced several special research project calls to ramp up national R&D efforts against the epidemic.

- The first 5 projects has been selected by DST-SERB for support for further development into implementable technologies.
- Three of these projects concern the highly important issue of antiviral and virustatic surface coating of inanimate surfaces, such as PPE.
- One project deals with the identification of metabolite biomarkers in COVID-19-infected patients enabling therapeutic target identification.
- Another project concerns with the development of antibodies against the receptor-binding domain of the spike glycoprotein of coronavirus.

J) DST sets up rapid response centre at SINE, IIT Bombay to combat COVID-19

- DST, in a quick response to combat COVID-19 global pandemic, approved setting up of a Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH) at a total cost of Rs. 56 Cr to scout, evaluate and support the innovations and start-ups that address COVID-19 challenges.
- The Society for Innovation and Entrepreneurship (SINE), a technology business incubator at IIT Bombay supported by DST has been identified as the Implementing Agency of the CAWACH.
- CAWACH will identify up to 50 innovations and start-ups for novel, low cost, safe and effective ventilators, respiratory aids, protective gears, novel solutions for sanitizers, disinfectants, diagnostics, therapeutics, informatics and any effective interventions to control COVID-19.

K) Challenge COVID-19 Competition (C3)

- National Innovation Foundation – India (NIF), an autonomous institute under the DST has come up with a call inviting innovative citizens to participate in its Challenge COVID-19 Competition (C3).
- Interested innovators are welcome to participate with their creative ideas and innovations for problems or issues like reducing transmission of Coronavirus through original creative ideas, innovations, which can supplement the efforts of the government in slowing or eliminating the spread further, innovative ideas which can make activities like sanitizing one's hands, body, and home items etc.
- Ideas are also invited for gainful engagement of people at home, healthy food for nutrition and boosting immunity especially at the time of lockdown when raw materials are limited, (Personal Protective Equipment) PPE's and rapid diagnostic testing facilities for capacity building of healthcare and other areas.

L) Integrated geospatial platform to help area-specific strategies & decisions in COVID-19 outbreak

- DST has created an Integrated Geospatial Platform out of available geospatial datasets, standards-based services, and analytic tools to help decision making during the current COVID-19 outbreak and aid devising area-specific strategies to handle the socio-economic impact in the recovery phase.
- The platform is initially expected to strengthen the public health delivery system of the State and Central Governments and subsequently provide the necessary geospatial information support to citizens and agencies dealing with the challenges related to health, socio-economic distress, and livelihood challenges.
- The mobile application SAHYOG as well as the web portal (https://indiamaps.gov.in/soiapp/) prepared and managed by the Survey of India (SoI) has been customized to collect COVID-19-specific geospatial datasets through community engagement to augment the response activities by Government of India to the pandemic.

M) TIFAC releases a white paper on COVID-19 interventions

- The Technology Information, Forecasting and Assessment Council (TIFAC) released a White paper on "Focused Interventions for 'Make in India': Post COVID 19". The White Paper captures sector-specific strengths, market trends, and opportunities in five sectors, critical from the country's perspective that includes, healthcare, machinery, ICT, agriculture, manufacturing, and electronics with reference to supply and demand, self-sufficiency and mass-scale production capacity.
- It has identified policy options primarily in the areas of Public health system, MSME sector, Global relations: FDI, recalibrated trade alignments, new-age technologies, etc.
- This is important for the development of technology clusters in champion segments, creating Technology Start-up Exchange, identifying, supporting, and piloting ten blockbuster technologies and collaborating with new dynamics with incubators of Israel and Germany, towards promoting import substitution as well as evolving technology platforms in sunrise technologies.
- The recommendations are directed towards giving immediate technology and policy impetus to make India "ATMANIRBHAR". Based on the linkages and interdependencies between the outputs of different sectors, output multiplier and income multiplier for various sectors have been presented in the paper.

N) DST supported start-up offers digital platform to monitor ground level situations by integrating with drones for COVID-19

- FlyBase, an enterprise incubated at the Bhau Institute's Incubation Centre, Government College of Engineering, Pune, Technology Business Incubator (TBI), under a DST NIDHI TBI Scheme is offering a digital platform that can monitor ground-level situations by integrating with drones.
- The platform called FlytNow allows drones—increasingly being used for aerial monitoring, emergency response, or urgent delivery of blood samples, medicines as well as lockdown surveillance, to be operated remotely for managing different aspects of COVID-19.
- Via FlytNow, police authorities are now carrying out live, remote drone operations to monitor the overall social situation through an operator-friendly dashboard and take measures to monitor crowds and maintain public safety.

4. Initiatives by different Divisions of DST

I. National Science & Technology Entrepreneurship Development Board (NSTEDB Division)

The National Science & Technology Entrepreneurship Development Board, DST has supported various start-ups providing COVID-19-related solutions under Seed Support Programme and has also set up the Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH) to scout, evaluate and support the innovations and start-ups that address COVID-19 challenges faced by the society.

Centre for Augmenting WAR with COVID-19 (CAWACH) Programme

The funding support is aimed at helping the start-ups to meet capital expenditure and recurring expenditure for producing quantities to meet market needs. This programme is meant to

support product, solutions and innovations in the areas of diagnostics, therapeutics (drugs, vaccines, devices, ventilators & PPEs, informatics including bio-informatics & information management systems, any intervention) for the control of COVID-19 and/or start-up ideas to address/mitigate various challenges faced by country/society due to severe impact of COVID-19.

i) Implementation Stakeholders of CAWACH Programme

The Society for Innovation and Entrepreneurship (SINE) the TBI (Technology Business Incubator) supported by DST at Indian Institute of Technology, Bombay was identified as the Implementing Agency of the Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH). SINE IIT B has implemented CAWACH under the guidance of DST and start-up incubation and eco-system.

The CAWACH programme has been implemented in partnership with associations with Satellite Centres, Ancillary Centres and partners who are having expertise and track record of supporting start-ups in healthcare areas.

ii) Satellite Centres of CAWACH Programme

SINE, IIT Bombay
Foundation for Innovation and Technology Transfer (FITT), IIT Delhi
Foundation for Innovation and Research in Science and Technology (F.I.R.S.T), IIT Kanpur
Healthcare Technology Innovation Centre (HTIC), IIT Madras
Venture Centre, NCL Pune
IKP Knowledge Park, Hyderabad
KIIT Technology Business Incubator, KIIT Bhubaneswar

PSG-STEP, Coimbatore -Ancillary Centre of CAWACH Programme
VIT-TBI, Vellore - Ancillary Centre of CAWACH Programme

iii) Implementation Partner of CAWACH Programme

Indian STEPS and Business Incubator Association (ISBA) : SINE, IIT B the CAWACH Monitoring Centre (CMC) is responsible for the overall implementation and monitoring of the CAWACH programme with the help of Satellite Centre, Ancillary Centre and ISBA. The roles and responsibilities have been duly documented amongst all the stakeholders of the CAWACH programme.

iv) Implementation Status

A nationwide call for applications was opened on April 6, 2020 and was closed on April 20, 2020. The entire process of sourcing application and first level screening was conducted on the portal developed by ISBA https://isba.in/cawach/. The response to the call was encouraging; a total number of 826 applications were received during the call period. The process of evaluation and screening has commenced with the help of satellite centre, ancillary centre and ISBA. A snap shot of the status of application is given under:

Total Applications received: 826

Bifurcation of total application Thrust Area-wise

Thrust Area	Total applications (No)
Informatics	264
Sterilizers & Disinfectants	203
PPE	100
Ventilator &respiratory care devices	73
Diagnostics:	64
Others	54
Other Medical Equipment	51
Drugs and Vaccines	17
Total	**826**

v) First level screening

Out of 826 applications, total eligible 641 applications were evaluated for First level of screening by a group of experts from various thrust areas at the respective Satellite and Ancillary centres. The scrutiny of 641 applications was conducted from April 27 to April 30, 2020. Pursuant to the scrutiny of 641 applications, a total of 105 eligible applications were shortlisted and recommended by the satellite centre to the CAWACH Empowered Committee.

vi) Second level screening

This stage comprised of allocating specific thrust area to the respective satellite centre based on the domain expertise available, online presentation by the applicant to the empowered committee comprising of experts and officials from DST and TDB. This process was conducted between 18th May to 21st May 2020.

Out of the total 105 applications, 54 applications have been shortlisted (provisionally) for support under the CAWACH programme. The selected solution comprises of High sensitivity rapid Antigen-antibody COVID diagnostic kits, PCR-based testing kits, X-ray-based COVID diagnostic and disease monitoring, Contactless digital stethoshope, Mask manufacturing machine, Mask integrity test setup, Nanomaterial coated antiviral, re-usable PPEs, Screening and remote monitoring telemedicine platform, Wearables to track and ensure social distancing, Oxygenerator, Ventilator, Microplasma oxidation-based sterilization, Silver nanoparticle-based alcohol-free sanitizer. The total amount recommended by the empowered committee is Rs. 4091.34 lacs. The financial due-diligence is underway of these provisionally selected start-ups.

vii) Thrust area-wise breakup

Thrust Area wise	No. of companies	Amount (Rs. in lacs)
PPE	13	720.29
Diagnostics and Drugs & Vaccines	10	1,150.00
Informatics	16	1,030.00
Disinfectants and Sterilizers	10	725.75
Ventilator and Other Medical Equipment	5	465.30
Total	54	4,091.34

The CAWACH centre is in the process of completing the modalities with regards documentation and finalising the agreements with reference to deliverables, milestones, utilisation of funds etc.

II. Seed Support System

The NSTEDB, DST supported Seed Support System (SSS) is to ensure timely availability of the seed support to the deserving incubatee start-ups within an incubator, thereby enabling them to take their venture to next level and facilitate towards their success in the marketplace. The scheme also enables the incubator to widen their pipeline of start-ups and also share the success of their start-ups which would also result in ensuring their long-term operational sustainability.

DST has extended directives to the TBIs to utilise seed fund on priority basis for supporting start-ups working solutions for COVID-19-related challenges. The incubators have also initiated specific calls on this and funded start-ups providing solutions for COVID-19-related challenges.

International Cooperation Division

International cooperation division is working proactively to support the nation's R & D efforts to fight against COVID-19 by negotiating with other countries to work together for solution-oriented research. Several encouraging responses have been received from many countries like Denmark, Australia, Egypt, Israel, Japan, Portugal, Korea, Norway, Serbia, Singapore, Slovenia, South Africa, United Kingdom, and United States. Some of the actions taken so far and received proposals are as follows:

i. Keeping in mind the current COVID-19 crisis, IC division has announced Indo-US (15th April 2020) and Indo-Australia joint Call (05th June 2020) to support the research projects which aims to find out the effective solutions against the pandemic and also to prepare the tools to upgrade the present healthcare system.

ii. Included 'S&T Solutions against COVID-19/ Pandemic' as one of the research area for joint R&D collaboration and to develop a new product /including trying for re-purposing of existing equipment under ongoing calls of India-Portugal (01 May 2020), India-Slovenia (10 Mar 2020) and India-Serbia joint call 2020 (24 Feb 2020).

iii. A joint R & D call for diagnostics, vaccines and therapies and repurposing of drugs on COVID-19 with BRICS countries planned to launch in 01 July 2020.

iv. A joint R&D Call is under discussion with European Commission and UK in the areas like therapeutics, advanced modelling and computer techniques, improved epidemiology and public health.

v. All the approved projects by DST are shared with our International partners to explore the possibilities of cooperation.

vi. Research projects initiated by Denmark on COVID-19 has been shared with Indian research community through SERB to explore possibility of cooperation.

vii. To connect Indian industry R & D efforts on COVID-19 internationally, proposal is under discussion for Industrial R & D projects with VINNOVA (Sweden) and Israel Innovation Authority (Israel) for researchers, start-ups and companies.

viii. A technology transfer Call is under discussion with Ethiopia and Rwanda. Zambia has requested for Hydrogen peroxide chamber developed by SCIMS.

ix. Technology offers received from UK, Norway, Singapore, Japan and Portugal are shared with DST technology groups (NEB, Nano mission and TDB) to analyse the national needs to take them forward. Based on technology groups feedback technology adoption can be facilitated.

x. Efforts have been made to connect Indian and Italian researchers working on specific problem of COVID-19. Initial discussion took place on sharing strategy implemented by Italy and India to tackle COVID-19. Both sides have been discussing possibilities of taking advantage of the "use" of a broader epidemiological basis and to explore possible

interactions also in the context of emergency management models (management in hospitals and society). A webinar on connecting Indian and Italian laboratories working on Genetics of Disease Outcome; Basic Research for Therapy & Prevention; and Artificial Intelligence for Surveillance and Prediction was proposed to be organised on 14th July 2020.

xi. Due to the lockdown, many researchers were stranded abroad. The Division has contacted each every individual and connected them to respective Indian embassy. Based on the need and requirement, about 50 researchers were evacuated safely to India from countries like Italy, France, UK ,USA etc. in coordination with MEA.

xii. All the research scientists/student working in Indian research laboratories in various fellowship programmes were provided up to 3 month extension of the fellowship as they were not able to fly back to their own country due to flight restrictions after completion of the fellowship period. Efforts were also made to send about 10 of them back to their country via special flights in coordination with their country embassy and MEA.

III. Initiatives of NRDMS Division: Geospatial-based solutions to address the challenges in COVID-19 crisis

In a response to combat COVID-19 pandemic-related challenges, National Geospatial Programme Division (*erstwhile NRDMS*) of the DST has made efforts to integrate available geospatial datasets, standards-based services, products, applications; and analytic tools from its attached offices and programme divisions. The attached offices, such as, Survey of India (SoI), National Atlas & Thematic Mapping Organisation (NATMO), and the DST's programme division, National Spatial Data Infrastructure (NSDI), have pulled together their resources to provide the integrated geospatial platform for not only addressing the present geospatial needs of the decision-makers but also devising area-specific strategies for socio-economic development in the post-COVID-19 mitigation scenarios.

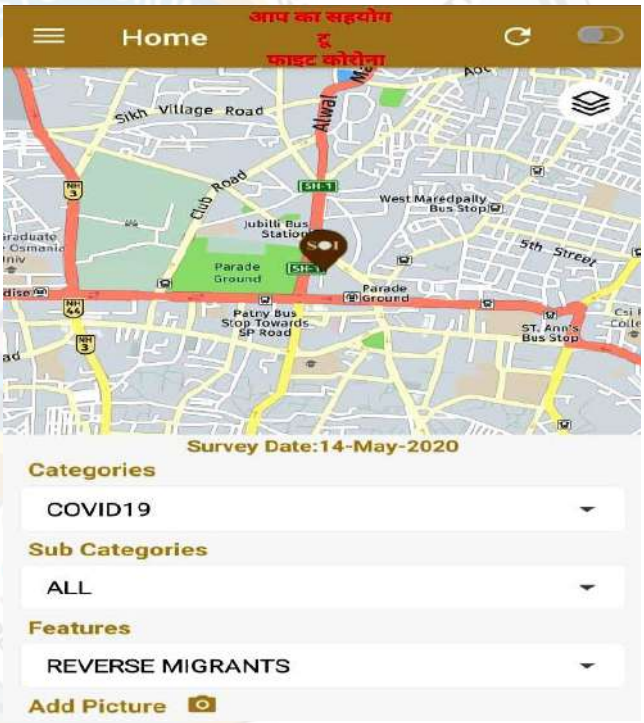


Figure 1. Screen shot of Sahyog mobile App of Survey of India depicting the added feature of reversed migrants

Survey of India (SOI) portal www.indiamaps.gov.in/soiapp/ is available as the core of the integrated geospatial platform to address COVID-19 outbreak and its socioeconomic impact. For required data collection pertinent to COVID-19 emergency management, the Sahyog mobile App of SOI has been customized. The App contains interface in local language viz. Hindi to capture data on the problems of reversed migrants (Fig. 1). The collected data is hosted on the above platform and for that a POI (point of interest) has been also created.

Under NSDI, many State Spatial Data Infrastructure (SSDI) teams have utilized the Sahyog mobile App of SoI for collecting data for Covid-19. In Karnataka state, 100 sample points for testing/training on Sahyog app from all 30 districts have been uploaded to the SoI Geoportal. Similarly, the GIS cells in all 13 districts of Uttarakhand State are sensitized for using Sahyog app. In Uttarakhand, geotagging of dedicated COVID-19 Centres/isolated COVID Centres institutional quarantine centres with their attributes has been done. Data of the reversed migrants such as travel history of reversed migrants, place of migration, cause of migration, education level, technical skill, marital status, income at migrated place, income at home, what want to do now, expectation from government etc. have also been collected in the State.

The functioning of NGOs of Science for Equity, Empowerment & Development (SEED) division of DST has been strengthened with basic geospatial tools and techniques so the outputs could be scaled up as per the current needs of the stakeholders in the COVID-19 scenario.

NATMO is in the process of launching a web-based thematic map service by combining its authoritative and reliable Atlas-based boundary data sets from its geoportal (http://geoportal.natmo.gov.in) with the health-related data sets from the Central and State-level health authorities. The thematic maps provided at different levels of the governmental hierarchy (National, State, and District levels) will help provide the details of the unfolding geospatial patterns of COVID-19 occurrence.

In order to strengthen the Geospatial analytics capabilities of the integrated platform, a Call for proposals (short-term) to address the COVID-19 crisis has been initiated in Collaboration with AGNIi (Accelerating Growth of New India's Innovations) initiative of office of the Principal Scientific Adviser to the Government of India. Spatial analytics will be used to address issues pertinent to migratory workers viz. employment generation, strengthening of livelihood, community resilience etc.

These key geospatial inputs with integrated geospatial information content are expected to be useful for the decision makers and local authorities in preparing operational strategies in the present and future outbreak scenarios.

IV. Initiatives of NCSTC Division

In order to facilitate necessary actions and to ensure preparedness of the society well to face the challenge and threat posed by the growing pandemic of COVID-19, NCSTC conducted a divisional meeting of its scientists on 07th April, 2020 through video conferencing. Various strategies about involving Academic Institutions and S&T-based Voluntary organizations supported through NCSTC were discussed during this meeting.

In the current scenario, where there is lot of anxiety, depression and challenges *vis a vis* translation and usage of common minimum science and authentic information to communicate the risks and facilitate risk management, an immediate and effective science communication for promoting community level response was desired. Here are some important initiatives of NCSTC:

- Online call for proposals has been made on e-PMS portal for Year of Awareness on Science & Health (YASH).
- COVID Katha, an interactive, online multimedia guide was developed and it's was released by Hon'ble Minister of Science & Technology and Earth Sciences on 03rd May 2020, at the start of Golden Jubilee celebrations of the Department of Science & Technology.
- Illustrative brochure was brought out for YASH initiative.
- Webinar series, "Science Communication in the time of COVID 19" was with implementation by Gujarat Council of Science & Technology organised every day during 10 May - 16 May 2020.

5. Initiatives by different Autonomous Institutions of DST

I. Initiatives by Science & Engineering Research Board (SERB)

Considering the emerging healthcare requirements to combat the COVID-19 epidemic, Science & Engineering Research Board (SERB) announced rapid/short-term projects of one year duration in the various thrust areas, preferably with multidisciplinary efforts under Core Research Grant (CRG) to urgently ramp up national R&D efforts against the epidemic. The first call was announced on 16th March. The final recommendations of the first set of 5 projects after peer-review and assessment by a Special Expert Committee for COVID-19 projects was done within a fortnight by DST-SERB. Three of these projects concern highly important issue of antiviral and virustatic surface coating of inanimate surfaces, such as personal protection equipment (PPE); while another one deals with the identification of metabolite biomarkers in COVID-19-infected patients enabling therapeutic target identification; and the last one concerns with the development of antibodies against the receptor binding domain of the spike glycoprotein of coronavirus.

The second call by DST-SERB on CRG was announced on 18th March with following thrust areas:

- Antiviral nanomaterials and bionano antiviral systems;
- Drug repurposing against key COVID-19 targets;
- Affordable, portable rapid diagnostic kits/tools;
- Computational identification and validation of COVID-19 molecular targets;
- In-vitro/clinical dose testing of nutritional supplements for immunity.

As a response to this call for proposals, a total of 768 proposals under Life Sciences (LS) and 172 under Chemical Sciences (CS) were received from the researchers throughout the country till the last date of submission, 30th April 2020. To gear up the research activities, a mid-term screening and review of 94 projects under LS received till 15th of April by Programme Advisory committee (PAC) experts and further assessed by the Task Force on COVID-19 for their suitability for funding was done in 2-3rd week of April and the following six proposals were recommended for funding:

i. Ten-minute paper-based test kit to detect SARS-CoV-2;
ii. Rapid, affordable, portable SARS-CoV-2 screening kit for resource-limited settings;

iii. Re-purposing of approved drugs from Drug Bank database for possible treatment for COVID-19 by targeting SARS-CoV-2 main protease;
iv. Molecular Beacons-based detection of novel SARS coronavirus-19 (CoV-2);
v. Single ventilator design modification for optimal multi-patient use - A CFD study;
vi. Development of host-directed anti-coronavirus agents.

Similarly, the CRG proposals under Chemical sciences were also assessed during the mid-term with a screening and review of 17 projects received till 21st of April by Programme Advisory committee (PAC) experts constituted as Special Task Force committee on COVID-19 for their suitability for funding in 4th week of April and the following five proposals were recommended for funding:

i. In silico screening for repurposing known drugs for SARS-CoV-2 using AI and molecular simulations;
ii. Extremely Water Repellent Coating for Anti-Viral Application;
iii. Cost-effective,Antiviral and Antibacterial textile-based face mask using facile and industrially scalable air-brush technology;
iv. Bioinspired copper coordination polymers as filter for COVID-19: targeting catalytic site of virus;
v. Evaluating the potential antiviral efficacy of functional carbon quantum dots loaded with Ketorolac salt against SARS-CoV-2.

Till now, some of these research-driven and technology-based interventions have been initiated on war footing to fight out the outburst of the pandemic. Among the remaining proposals, screening and shortlisting has been completed and the proposals are submitted for further review by subject experts. The details of sub-area wise proposals received under CRG scheme Life Sciences Programme is shown in Table 1.

Table 1: CRG proposals received under various sub-areas

S. No.	Sub area	Proposals received
1	Antiviral nanomaterials and bionano antiviral systems	172
2	Affordable, portable rapid diagnostic kits/tools	250
3	Computational identification and validation of COVID-19 molecular targets	212
4	Drug repurposing against key COVID-19 targets	214
5.	In-vitro/clinical dose testing of nutritional supplements for immunity	92
		940

The officials across the funding agencies and the scientific community at the other end geared up their efforts and worked tirelessly since the outbreak to combat the epidemic of COVID-19. Another Special IRHPA Call (Intensification of Research in High Priority Area) for a 3-year duration specifically designed for COVID-19 and related respiratory viral infections was announced on 23rd March with the last date of 30th April for the receipt of full proposals. The preference to multi-institutional network with industrial partnership to assist teams, preferably with multidisciplinary efforts in the area, was encouraged in the IRHPA call.

The thrust areas for IRHPA call specifically designed for COVID-19 and related respiratory viral infections were as follows:

i) New or repurposed antivirals against valid viral targets; viricidal coatings; etc.;
ii) Affordable diagnostics for symptomatic and asymptomatic respiratory viral infections;

iii) Investigational vaccines against respiratory viruses;
iv) Development of disease models for respiratory viral infections;
v) Studies on immune response and immunity during respiratory viral infections;
vi) Epidemiology of COVID-19 and other respiratory viral infections.

Multiple virtual meetings were held in succession to screen and review by subject experts for the 310 proposals received till 30th April 2020. The sub-area wise details of the **IRPHA** recommended projects is shown in Figure 2.

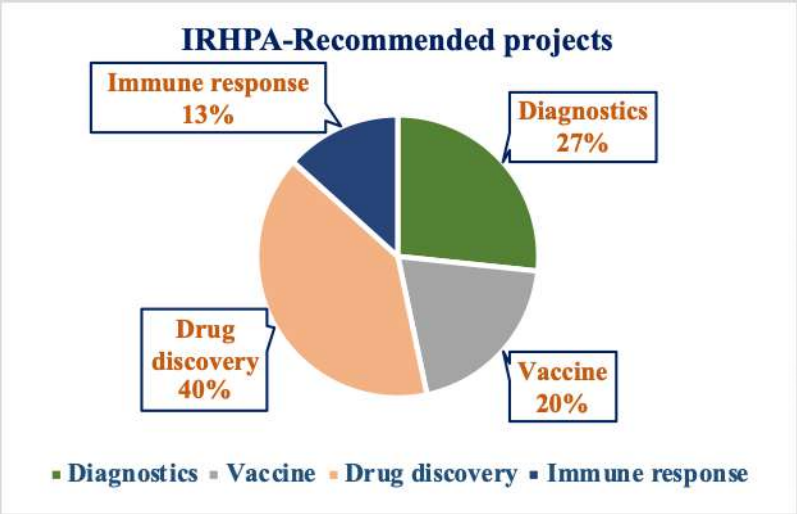


Figure 2: Details of IRHPA-recommended projects

Considering the importance to develop mathematical models to study the rate of spread of COVID-19 among the population and also the criticality of data driven inference for forecasting of coronavirus infections, SERB announced a special call for short-term projects under its MATRICS programme, preferably with multidisciplinary efforts in the following thrust areas:

- Mathematical Modelling of COVID-19 Spread;
- Statistical Machine Learning, Forecasting and Inferences from Pandemic Data;
- Focused Algorithms for Infectious Disease Modelling;
- Quantitative Social Science Approaches for Epidemiological Models.

The call was open from March 31 to April 30, 2020.

The number of proposals received were 624. First meeting of the MATRICS Special Call Task Force Committee was held virtually on April 23, 2020 to evaluate 68 proposals received till April 14, 2020. The committee recommended 11 proposals for support.

The list of approved proposals under MATRICS scheme are as follows:

- Modelling and Forecasting of COVID-19 pandemic;
- Mathematical Modelling of Transmission Dynamics of COVID-19 and its Control;
- Mathematical and Statistical Modelling of COVID-19 Outbreak in India;
- Modelling, Analysis and Prediction for SARS-CoV-2 Infections;
- Bayesian Individual-level modelling of the spread of COVID-19 Pandemic;
- Anatomy of COVID-19 transmission dynamics: A modelling and computational approach from Indian perspective;
- Effects of Nonpharmaceutical Measures on COVID-19 Pandemic in India and Network-based Forecast Beyond Relaxation of Lockdown;
- A network optimization-based prediction model for COVID-19 outbreak tree

- ❖ Optimization of lockdown, testing and isolating strategies to contain COVID-19 in India;
- ❖ Identification of possible cure of COVID-19 through study of DNA structures through Iterated Function Systems;
- ❖ Multi-cluster models for epidemic spread and evaluation based on data-driven parameterization.

The grants for the projects recommended under the first phase of PAC meetings are released/ under release and the monthly progress reports are being requested from the Principal Investigators for monitoring purposes.

Till now, the country has been able to contain the spread of the virus with the active participation of the population across various states through best practices of hygiene, hand washing, social distancing etc. However, immediate as well as long lasting interventions/strategies are needed, for which various ministries under GOI took forward steps.

As a premiere R&D funding agency, DST-SERB initiated the promotional R&D activities for proving various solutions for containment and prevention of COVID-19. With the initial in-house meetings and announcing the call for proposals by the middle of the March 2020, in multiples thrust areas across short (one-year duration) and long (three-year duration) calls. SERB will closely monitor the progress of the COVID-19 funded projects and endeavour to find S&T solutions to the alleviate this epidemic.

Research Projects by Science & Engineering Research Board (SERB) & DST

Title	Implementing Agency
Modelling and Forecasting of COVID-19 Pandemic	Indian Institute of Technology (IIT) Kanpur
Mathematical Modelling of Transmission Dynamics of COVID-19 and its Control	VIT University Chennai
Mathematical and Statistical Modelling of COVID-19 Outbreak in India	Indian Institute of Technology (IIT) Guwahati
Modelling, Analysis and Prediction for SARS-CoV-2 Infections	Indian Institute of Science Education and Research (IISER) Thiruvananthapuram
Bayesian Individual-level Modelling of the Spread of COVID-19 Pandemic	SYMBIOSIS International University
Anatomy of COVID-19 Transmission Dynamics: A Modelling and Computational Approach from Indian Perspective	Jadavpur University
Effects of Nonpharmaceutical Measures on COVID-19 Pandemic in India and Network-based Forecast Beyond Relaxation of Lockdown	Indian Institute of Technology (IIT) Guwahati
A Network Optimization-Based Prediction Model for COVID-19 Outbreak Tree	Indian Institute of Technology (IIT) Kharagpur
Optimization of Lockdown, Testing and Isolating Strategies to Contain COVID-19 in India	Indian Institute of Technology (IIT) Kanpur
Identification of Possible Cure of COVID-19 Through Study of DNA Structures Through Iterated Function Systems	Indian Institute of Technology (IIT) Roorkee
Multi-cluster Models for Epidemic Spread and Evaluation Based on Data Driven Parameterization	Indian Institute of Technology (IIT) Bhilai

Simulating with confidence: Accurate estimation in the study of COVID-19	Indian Institute of Technology (IIT) Kanpur
Spatio-Temporal Modelling and Analysis of COVID-19: A domestic and global perspective	University of Hyderabad
Adapting the standard SIR model for COVID-19 and effects of climate and lockdowns on infectious spread of SARS-CoV-2	Indian Institute of Technology (IIT) Chennai
Network-Based Prediction of COVID-19 Spread in India under Migration	Indian Statistical Institute (ISI) Kolkata
Modelling and Prediction of COVID-19 Outbreak: Analyzing Possible Effects of Lockdown, Testing and Urbanicity	Indian Institute of Technology (IIT) Kanpur
Identifying Important Factors Impacting the Spread and Mortality Rate of COVID-19 Using Biclustering Approach	Jadavpur University
Development of Prediction Model for COVID-19 using Machine Learning	Amity University
Healthcare Supply Chain and Capacity Modelling during a Pandemic	Indian Institute of Management (IIM) Calcutta
An SEIR model to estimate the effect of pharmaceutical and non-pharmaceutical interventions on the spread of Covid19	Indian Institute of Technology (IIT) Chennai
Theoretical Model for Inactivation Kinetics of Infectious Human Corona Virus on Metal Surfaces	University of Delhi, North Campus
Modelling the impact of sensor performance on epidemic management	Indian Institute of Science (IISc) Bangalore
Containment Control over Economics Aware Local COVID-19 Infection Dynamics Networks	Indian Institute of Science (IISc) Bangalore
Mathematical modelling of aerosolized transmission of pathogens via turbulent expiratory events	Indian Institute of Technology (IIT) Chennai
Controlling Epidemics	Indian Institute of Technology (IIT) Bombay
Modelling COVID-19 to study the impact of various societal factors on the control of Pandemic	Indian Institute of Technology (IIT) Mandi
Repurposing of clinically approved drugs for SARS-CoV-2 (COVID-19) using systems pharmacology-based network modelling	Bharathidasan University
Real-time infectious diseases hazard map for India based on transportation networks	Indian Institute of Science Education and Research (IISER) Pune
Understanding the Efficacy of Existing Drug Molecules on COVID-19 through an Interactive Pathway: A Deep Learning-based Predictive Model	Indian Statistical Institute (ISI) Kolkata
Modelling the spread of the COVID-19 viral infection at the cellular level	Indian Institute of Science Education and Research (IISER) Bhopal
Identifying optimal immunization strategies in Indian context against COVID-19	Indian Institute of Technology (IIT) Bhilai

Modelling and Forecasting the Effects of Long-Term Interventions on COVID-19 using a Network-based Approach	Birla Institute of Technology & Science, Pilani - Goa
Efficient prediction strategy of COVID-19 based on pandemic data and immunoinformatics, integrated on artificial intelligence (AI) platform	Birla Institute of Technology & Science Pilani, Hyderabad Campus
DECOVID: Data-assimilation and Error Correction Of Viral Infectious Disease Models	Indian Institute of Science
Agent-based spatial modelling of COVID-19 pandemic for urban areas	Atal Bihari Vajpayee Indian Institute of Information Technology and Management
Development of Dynamic Mathematical Modelling for COVID-19 Spread and Containment	National Institute of Technology, Delhi
Modelling the spread of novel coronavirus (SARS-CoV-2) in host tissue and its potential epidemiological implications for COVID-19	Indian Institute of Technology (IIT) Bombay
Development of computational and visualization software for evaluating GPCR targeting drugs with the aim of mitigating coronavirus infection level	Indian Institute of Technology
Rapid, affordable, portable SARS-CoV-2 screening kit for resource-limited settings	Indian Institute of Technology (IIT) Hyderabad
10-minute paper-based test kit to detect SARS-CoV-2	Agharkar Research Institute (ARI) Maharashtra
Molecular Beacons-based detection of novel SARS coronavirus-19 (CoV-2)	National Institute of Immunology (NII) New Delhi
Re-purposing of approved drugs from Drug Bank database for possible treatment for COVID-19 by targeting SARS-CoV-2 main protease	Indian Institute of Technology, BHU, Uttar Pradesh
Single ventilator design modification for optimal multi-patient use— A CFD study	Indian Institute of Technology Delhi
Development of host-directed anticoronavirus agents	National Research Centre on Equines, Haryana
Identification of global metabolite biomarkers in CoVID-19 infected patients for targeted therapy	IIT Bombay
Development of functionalized inanimate surfaces with repurposable multitargeted viricidal agents/ drugs for preventive and cost-effective antiviral applications	IIT Kanpur
Development of antiviral surface coatings to prevent the spread of infections caused by influenza virus	JNCASR, Bangalore
Development of formulations for viral decontamination of inanimate surfaces	IIT Delhi
Antibody-based capture of 2019-nCoV and its inactivation using lipid-based in situ gel	IIT Bombay
In silico screening for repurposing known drugs for SARS-CoV-2 using AI and molecular simulations	Indian Institute of Technology Kanpur

Extremely Water Repellent Coating for Antiviral Application	Indian Institute of Technology Guwahati
Cost-effective, Antiviral and Antibacterial textile-based face mask using facile and industrially scalable air-brush technology	Indian Institute of Science, Bangalore
Evaluating the potential antiviral efficacy of functional carbon quantum dots loaded with Ketorolac salt against SARS-CoV-2	Institute of Life Sciences, Bhubaneswar
Development of Rapid Electrochemical-based Diagnostics for Detection of SARS-CoV-2 Infection	Advanced Materials and Processes Research Institute Madhya Pradesh
COVID-SCAN (Novel diagnostic platforms for point-of-care SARS-CoV-2 detection)	National Institute of Animal Biotechnology, Telangana
Immuno-epigenetics study of the humoral immune response in COVID-19 patients from India	National Institute of Immunology, Delhi
Discovery of structure-based antivirals against SARS-CoV-2 targeting key viral genome replication enzymes	Indian Institute of Technology Roorkee, Uttarakhand
Study to identify biomarkers to predict progression from non-severe to severe COVID-19 cases can help interventions	IIT Bombay
A predictive model by JNCASR can help prepare for medical needs for COVID-19	Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)
Coating developed by JNCASR may prevent transmission of infection	Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)
Rapid response centre at SINE, IIT Bombay	IIT Bombay
DST supported startup offers digital platform to monitor ground level situations by integrating with drones for COVID-19	Bhau Institute's Incubation Centre
A predictive model by JNCASR can help prepare for medical needs for COVID-19	Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)
Study to identify biomarkers to predict progression from non-severe to severe COVID 19 cases	IIT Bombay

For more information, visit: https://www.serbonline.in/SERB/HomePage

II. Initiatives by Technology Development Board (TDB)

The Technology Development Board (TDB), a statutory body under DST, invited proposals/ applications from Indian companies and enterprises on 20th March, 2020, to address protection and home-based respiratory intervention for COVID-19 patients. The areas in which technologically innovative solutions were invited include the following:

- Low-cost masks which can capture virus from the air and absorb respiratory droplets;
- Cost-effective Thermal Scanning;
- Large area sanitization and sterilization (including electrostatic spray and Ultra Violet treatment for various available surfaces like glass, ceramic, wood, textile, etc.);
- Bioinformatics and Surveillance;
- Rapid and Accurate Diagnosis kit (paper-based and other point-of-care devices);
- AI and IoT-based solution for contact-less entry;

- ❖ Oxygenators and ventilators (Low cost and portable);
- ❖ Any other related technology.

The Indian industry and the start-up ecosystem responded enthusiastically to the invitation by the TDB. The last date of submission for proposals was initially 30 Mar which was later extended to 30 Apr considering the response and requirement.

Nearly 350 companies registered themselves with TDB through online process and a total of 228 applications were received through online mode.

The received applications were processed phase wise based on the technical and financial details provided in the proposal, without waiting for the last date for submission of applications.

The project evaluation at TDB is quite exhaustive. Prior to the project proposal being approved for financial assistance by the Board, the proposal is evaluated by two separate committees. These committees consists of technical experts who are shortlisted from government/ academic institutions like IITs, IISc, NIV, AIIMS, ICMR, DST, DBT etc. and financial experts with over 15 years of experience in project finance.

TDB, through its evaluation process, has processed 194 applications under various domains and another 34 applications are in the final stages of evaluation. TDB has approved six projects towards commercialization, with a total commitment of Rs. 924 lakhs which include thermal scanners, medical devices, masks, and diagnostic kits.

Thermal Scanners

Hand-held thermometers, used in checking temperature, a common test for screening symptoms of virus infection, exposes security personnel and health workers to infection. Removal of current restrictions after lockdowns will further increase this risk.

Therefore, it becomes imperative to have non-intrusive technologies for monitoring body temperature from a distance and in the crowd. TDB has approved financial assistance to two Bangalore-based companies, Cocoslabs Innovation Solutions Private Limited and Advance Mechanical Services Private limited, which are poised to provide these solutions.

i) **Cocoslabs Innovation Solutions Private Limited** plans to commercialize a low-cost solution to identify persons with abnormal body temperature in a crowd and at the same time provide an alert system to notify about identified persons to authorities on their phones and laptops. An artificial intelligence software solution for real-time detection using video analytics platform for real-time alerts combined with a low-cost thermal camera (basic camera with only thermal image capture capability), & GPU servers are used for real-time abnormal temperature detection of multiple people at a given time in crowded public places.

   The product includes features such as detection and tracking a person with and without mask, prediction of age, gender, race, temperature readings (fever detection), and facial recognition in a single product that can track multiple people in a real-time environment.

ii) **Advance Mechanical Services Private limited** plans to commercialize Infrared Thermography-based Temperature Scanner for Rapid Measurement and Real-Time Decision Making using an uncooled microbolometer and video analytics platform. This has been indigenously developed, providing real-time alerts and analytics using AI and

IIOT (Industrial Internet of Things). The product design, imaging processing software, AI protocols development, and configuring of IIOT solutions have been developed in-house with due considerations for ruggedness, reliability and affordability. The company has also developed server technology, which is value-added feature for the IIOT systems.

Medical devices

i) **Iatome Electric India Pvt. Ltd., Coimbatore** envisages commercialization of battery-powered portable X-ray machines with digital display as standalone medical radiography equipment suitable for ICU and Isolation Wards. The device is portable and can be taken to the patient's bedside, thereby reducing the exposure of infection to the medical staff involved in the process. The battery back-up option is useful for a wireless workflow and continuous operation without power mains. Portable X-Rays with Digital Imaging and Battery Back-Up can be used in the isolation wards and Intensive Care Units of the COVID-19 management set-up.

Masks

i) **Thincr Technologies India Pvt. Ltd, Pune** is providing coating and 3D printing of anti-viral agents on the masks as a preventive measure against COVID-19. Sodium Olefin Sulfonate-based mixture is used for coating on the mask. It is a soap forming agent with hydrophilic and hydrophobic properties. In contact with enveloped viruses, it disrupts the outer membrane of the latter. The ingredients used are stable at room temperature and are widely used in cosmetics.

Diagnostic Kits

i. **Mylab Discovery Solutions, Pune**, the first indigenous company to develop real-time RT-PCR-based molecular diagnostic kit that screens and detects samples of people who display flu-like symptoms. This kit has been approved by ICMR and CDSCO. The company approached TDB with the project proposal for automation of their facility under the TDB's call for proposals for Fighting COVID-19. The proposal stipulated automation of the facility from current manual process, resulting in increase in its current capacity from 30000 tests per day to one lakh tests per day. The company is expected to complete the project in two months.

ii. **Medzome Life Sciencez, New Delhi** currently manufactures rapid diagnostic kits for Malaria, Dengue, Pregnancy, Typhoid, etc. and intends to manufacture fluorescence-based Rapid COVID-19 Antibody-based Detection Kit. It targets to deploy them commercially in 2-3 months. The fluorescence-based diagnostic kits are reported to be several-fold sensitive and shall be able to provide quantitative results. This test does not require well-established laboratory facilities or technical person and therefore is expected to be cost effective. The company is expected to develop a capacity of nearly 50000 kits per day.

TDB is proactively supporting the efforts of the scientists, technologists, entrepreneurs, and industrialists towards preventing and containing the spread of the COVID-19 pandemic by providing financial support for commercialization of these technologies. In addition, TDB is also scouting for novel solutions for supporting the country's efforts in tackling the healthcare emergency that the world is facing.

III. Initiatives by Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST)

In the wake of the crisis situation during the COVID-19 pandemic, the three wings of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) namely the Biomedical Technology Wing (BMT), Achutha Menon Centre for Health Science Studies (AMCHSS) and the Hospital Wing have tried their best to face the unprecedented emergency situation.

A number of measures are taken for mitigating the effects of the COVID-19 pandemic not only for the institute but also for the entire country with the full utilization of resources and best of its capabilities. Though the institute had to quarantine a number of staff when a foreign returned doctor was detected with COVID-19 much before the nationwide lockdown, SCTIMST rose up to the occasion to bring out several technologies, products, and patient management guidelines that could be crucial to combat the disease not only for the institute, but for the state and entire country. Furthermore, SCTIMST has evolved a fast track method to come out with the biomedical devices, technologies and guidelines useful for the management of COVID-19 in the country, in addition to streamlining the management of patients with cardiac and neuro illnesses in the hospital wing.

A. BIOMEDICAL TECHNOLOGY WING

The BMT wing stood out with its research, technologies and innovations to meet the need of the hour in India's fight against COVID-19. Under the leadership of Director of the institute, it evolved a fast track method coordinating the all-round efforts of scientists, engineers and doctors on to develop the following technologies:

S. No	Devices	Features	Status
In Vitro Diagnostics Devices			
1	Chitra Magna RNA Isolation Kit	Uses innovative technology for isolating RNA using magnetic nanoparticles Enhances the chances of identifying positive cases Can help increase number of tests and bring down its costs	Technology transferred to M/s. Agappe Diagnostics Ltd, Kochi; Commercial launch over. Relicensed to M/s. Tata Sons Pvt. Ltd, Mumbai
2	Chitra Rapid Ab Antibody Test Kit	Immunochromatographic test kit method is used for detecting the presence of antibodies (IgG/IgM) against coronavirus in serum, plasma or whole blood. Will help to identify infection and isolate people without symptoms and suspected SARS-CoV-2	Technology transferred to M/s. Origin Diagnostics and Research, Kollam, Kerala; Internal validation in progress.

3	Chitra LAMP-N COVID test kit	Confirm SARS-CoV-2 using (RT-LAMP) Point-of-care diagnostic test which detects the N Gene Validation in progress	Technology transferred to M/s. Agappe Diagnostics, Kochi & M/s. Tata Sons Pvt. Ltd Internal validation in progress.
4	Chitra Embed Nylon Flocked Swab	Individually wrapped Nylon flocked swabs Sterile, ready-to-use devices for the collection of clinical samples Nasopharyngeal and oropharyngeal models available	Technology trasnfered to M/s. Mallelil Industries Pvt. Ltd, Kochi; Ready for large-scale manufacture.
5	Chitra ENMesh Swabs and VTM Kit	Swab made from polyurethane foam Viral Transport Medium (VTM): Specifically designed to retain the virus in its active form during transportation	Technology transferred to M/s. Origin Diagnostics and Research, Kerala and M/s. Levram Life sciences Pvt. Ltd., Mumbai Ready for commercial launch
Devices for Therapeutic Support			
6	Automated AMBU ventilator/ respirator	Automated AMBU-based ventilator for emergency respiratory support. Mild to moderate respiratory function Made with locally available material Portable & cost effective	Technology transferred to M/s. Wipro 3D, Bangalore; Ready for manufacturing in large scale.
7	MediCAB deployable isolation wards, hospitals, ICUs	Deployable isolation hospitals to combat COVID-19 with four zone strategy. Co-developed with M/s. Modulus Housing, Chennai.	Technology transferred to M/s. Debrique Creative Labs Pvt. Ltd, Chennai; First unit deployed in Chennai; Ready for large scale manufacture.
Devices for Isolation /Barrier Creation			
8	Chitra Isolation Pods	Isolation pod device is an enclosure for carrying the COVID-19 infectious patients from one place to another.	Technology transferred to M/s. HMT Ltd, Kochi Ready for manufacture Relicense to M/s. Kerala State Drugs and Pharmaceuticals being taken up
9	Chitra Clinical Examination Booth	Technology transferred to: M/s. HLL Lifecare, Trivandrum M/s. Shivapriya Exim, Chennai M/s. HMG India, Mumbai M/s.TVS Supply Chain, Bangalore JADRO Steel, Kolkata	M/s. HLL Lifecare and M/s. TVS Supply Chain Solutions started marketing the product.

10	Chitra Single Chamber Swab Collection Booth	Technology transferred to: M/s. HLL Lifecare, Trivandrum M/s. Shivapriya Exim, Chennai M/s. HMT, Kochi M/s.TVS Supply Chain, Bangalore JADRO Steel, Kolkata	M/s. HLL Lifecare, M/s. HMT and M/s. TVS Supply Chain started marketing the product.
11	Chitra Double Chamber Swab Collection Booth	The dual-chamber swab collection booth is designed to have one chamber for the health worker and the second chamber for the suspected case of an infectious disease such as COVID-19.	Technology transferred M/s. HLL Lifecare, Shivapriya Exim, HMT, TVS and JADRO Steel Ready for manufacture.
Devices for Disnfection			
12	UV-based face mask disinfection bin	Ultraviolet (UV)-based facemask disinfection bin indicated for disinfecting used facemasks prior to disposal. Reduces the risk waste collectors being exposed to hazardous waste.	Licensed to M/s. VST Mobility Solutions, Kochi Commercially launched Relicensed to M/s. PMG Equipment, Hyderabad and M/s. Vivesty Green Recyclers, Kozhikode
13	UV-based multipurpose disinfector	UV-C-based disinfection system Multi-purpose design Applications in shops, public places	Licensed to M/s. VST Mobility Solutions, Kochi. Commercially launched
14	Chitra Disinfection Gateway	System for generating Hydrogen peroxide mist and UV-based decontamination facility. Hydrogen Peroxide fumes will decontaminate the body, hands, and clothes of a person. The UV rays will decontaminate the chamber.	Technology licensed to eight companies spread across the country. Started deployment at various locations.
15	Acrylosorb Advanced super absorbent	Solidifies the secretary fluids from infected personnel and disinfects the fluid Reduces the risk to personnel carrying out waste disposal process.	Technology Licensed to M/s. Kerala State Drugs and Pharmaceuticals, Alappuzha

Patent Applications			
S. No	**Application No**	**Filing Date**	**Title of Invention**
1.	202041013409	27/03/2020	Developing point-of-care testing protocol based on RT-LAMP for rapid detection of coronavirus SARS-COV-2
2.	202041014164	31/03/2020	Deployable field units for emergency response.

3.	202041014183	31/03/2020	Deployable hospitalised partitions
4.	202041014200	31/03/2020	Face masks sanitization bin
5.	202041014210	31/03/2020	Cough and sneeze mask with specimen collector for respiratory droplet specimen collection.
6.	202041014221	31/03/2020	Automated artificial manual breathing unit ventilator
7.	202041014548	01/04/2020	Isolation pod for the isolation/ transportation of infected patients.
8.	202041015253	07/04/2020	Digital sanitation mobile app
9.	202041014706	02/04/2020	Ventilating patients for emergency care
10.	202041014851	03/04/2020	Battery-operated assistive breathing unit
11.	202041014965	04/04/2020	Disposable safety face shield
12.	202041015213	07/04/2020	Surface modification of masks and gloves for viral inactivation
13.	202041015783	11/04/2020	Oropharyngeal swab
14.	202041015199	07/04/2020	Rapid detection of COVID-19 antigens using immunochromatorgraphic techniques
15.	202041015212	07/04/2020	Rapid detection of COVID-19 IgG/IgM antibodies using immunochromatographic techniques.
16.	202041015384	08/04/2020	Development of remote controlled non-touch opening dustbin with integrated disinfection mechanism base on UV light for infection control in COVID-19 outbreak
17.	202041015131	06/04/2020	A formulation dispensing system worn as a hand bracelet
18.	202041015399	08/04/2020	Disposable disinfectant absorbent sponge
19.	202041015441	08/04/2020	Disinfection walk-through /gateway
20.	202041015611	09/04/2020	Examination booth
21.	202041015925	13/04/2020	Swab collection booth
22.	202041016055	14/04/2020	Level A personal protective equipment with continuous air supply for medical/ surgical use
23.	202041016519	16/04/2020	Rapid viral RNA isolation protocol
24.	202041016758	18/04/2020	Automatic smart-bin with combined UV-enabled microwave-based disinfection of hospital waste
25.	202041019872	11/05/2020	A system for immobilization and safe disposal of respiratory secretions in hospitals
26.	202041018961	04/05/2020	Dual-chamber swab collection booth
27.	202041019145	05/05/2020	Intubation isolation box
28.	202041020015	12/05/2020	Universal transport medium
29.	202041020378	14/05/2020	Flocked swabs and the process of manufacture thereof

COVID-19 MANGEMENT – INCUBATION ACTIVITIES (SCTIMST TIMed)

SCTIMST-TIMed is a Technology Business Incubator for Medical Devices and Biomaterials funded by the DST. In the COVID-19 crisis situation, TIMed has been working on fast track mode to reach out to the innovators or companies and to support them. Brainstorming sessions were held with existing start-ups and Prayasees of TIMed to come up with quick to market interventions that could be manufactured even in the lockdown situation.

S. No	Device	Features	Status
1	Medical Grade Thermal Scanner	• For airports, malls, large offices etc. • Thermal Eye Body Temperature IR Scanner to get an accurate body temperature of a person on an automated platform. • CDSCO registration, production planning and marketing activities in progress.	Incubatee: M/s. Avatar Renewables Pvt Ltd, Kochi (NIDHI PRAYAS Scheme)
2	Face Barrier and Shields	Three variants of face shields namely, • Modified scuba diving mask with Virus filter • Full covered non permeable Head hood with air exchange • Face shield barrier	Incubatee: Dr Praveen Pai (NIDHI PRAYAS Scheme)
3	Face Shields	• Safety face shields • Reusable shields • Already started marketing	Incubatee: M/S Creativity Council (NIDHI PRAYAS Scheme)

B. ACHUTHA MENON CENTRE FOR HEALTH SCIENCE STUDIES (AMCHSS)

The Achutha Menon Centre at the Institute is actively involved in supporting the Hospital Wing and the State in the containment of COVID-19 through the COVID Cell constituted by the Director at the Institute. Further, it is helping the State Health Department also by preparing a number of new initiatives and proposals.

Involvement in the support to COVID-19-related activities of the Institute.

1. February 1st – Sensitisation on COVID-19 for staff of SCTIMST – staff from all three wings joined. BMT wing staff and field staff from Wayanad joined over zoom (Dr Biju took the lead in arranging).
2. February onwards AMC staff interacted with various staff of SCT individually and in small groups to clear doubts and raise awareness on COVID-19.
3. Three members of AMCHSS are members of the COVID Cell of the institute – Dr Sankara Sarma, Dr Biju Soman and Dr Rakhal Gaitonde. This cell coordinates and makes decision regarding all COVID-19-related decisions in the institute.

4. The AMC team contributed to coordinating the public health and other aspects of the institute's response to one of our staff member testing COVID-19 positive. This included the following:
    i. Coordination of contact tracing activities and decision – Dr Biju Soman was part the team of faculty that did this activity.
    ii. Re-classification of contacts into high risk and low risk – Dr Biju Soman led the team.
    iii. Development of Rapid Survey tool to survey the whole of the institute – Dr Biju Soman and Dr Rakhal Gaitonde contributed to development of the tool.
    iv. Designing the Campus Cohort study protocol – which follows those who were in quarantine as contacts of the positive faculty. Dr Biju Soman and Dr Rakhal Gaitonde in association with the Team from NIE, Chennai.
    v. Formation and initial support of nearly 700 members Whatsapp support group for staff – Dr Rakhal Gaitonde and MPH students of Batch of 2019. Later support was taken over by other faculty and staff.
    vi. Intensive telephone counselling and support to those in quarantine – team led by Dr Ravi Prasad Varma and PhD and MPH students of 2019 batch.
    vii. Development of material for support of those in quarantine – Dr Jeemon, Dr Manju and Dr Ravi Prasad Varma.
    viii. Dr Ravi Prasad Varma has joined the Institute Infection Control Team (ICT) and is providing public health inputs. He is supporting the Social Work Department in daily screening of patients, developing protocols and monitoring implementation of these in the Hospital and AMC campus.
    ix. Developed an English (Dr Ravi Prasad Varma, Dr Srikanth, Dr Manju Nair, Dr Jissa VT) and Malayalam (by Ravi Prasad Varma, Jissa, Rajalakshmi (MPH student)) webinar on epidemiological basis of COVID-19 in Malayalam for ICT.
    x. Dr Mala Ramanathan as member secretary of Institutional Ethics Committee (IEC) – April 1, 2020: Developed two SOPs for dealing with the COVID-19 pandemic situation and implemented them for the IEC functioning. Put in place expedited IEC review protocols. IEC reviews are now being processed in 72 hours. These protocols were developed based on the ICMR guidelines (Of 2017) section on Ethics in Humanitarian/Disaster situations. Proposals received under the COVID-19 protocol of IEC: 7. Number of proposals approved: 6.
    xi. Dr Ravi Prasad Varma - Preparing COVID-19 high-risk district list every alternate day to facilitate patient triaging.
    xii. Dr Ravi Prasad Varma - Contributed to the SCTIMST-Infection Control Manual for COVID-19 (dated 22-04-2020).

Involvement in supporting Government of Kerala

1. Dr Rakhal Gaitonde, Professor, AMC was appointed on to the State Government Expert Committee on COVID-19. This committee is chaired by Dr Ekbal, Member, State Planning Commission.
2. AMC team consisting of Dr Rakhal Gaitonde, Dr Sankara Sarma, Dr Biju Soman and Dr Jissa VT helped develop three proposal submitted to Government of Kerala as Technical support, these are protocols for epidemiological and sero-prevalence surveys. These proposals include:
    a. Epidemiological studies on COVID-19 in Kerala, SCT COVID STUDY GROUP 001.
    b. Sero-epidemiological study of COVID-19 in State/Union Territory, India: Among community members, contacts and healthcare workers. SCT COVID STUDY GROUP 002.
    c. An exploration of sero-prevalence of COVID-19 in Kerala using facility-based samples. SCT COVID STUDY GROUP 002a

3. Dr Manju Nair developed and submitted a comprehensive sentinel surveillance programme for the Trivandrum District Disaster Management Authority.

Involvement in support to Central Government

1. Dr Rakhal Gaitonde, Professor, AMC was appointed to the National Task Force on COVID-19 by ICMR. He was appointed as a member of the Operations Research/ Implementation Research Group.
2. Dr Gaitonde was appointed as convenor of the Health Systems Working sub-group of the OR/IR Task force of the ICMR.

Academics, Research and Publications

1. Publications from AMCHSS:
   a. Varma RP. Alcohol withdrawal management during the Covid-19 lockdown in Kerala. *Indian J Med Ethics*. 2020;V(2):105-106. doi:10.20529/IJME.2020.042
   b. Singh G, Srinivas G, Jyothi EK, Gayatri LK, Gaitonde R, Soman B. The Sree Chitra experience in containing the first outbreak of COVID19 in a healthcare setting in India. Indian J Public Health 2020;64:S1-S4.

2. Publications being prepared as part of COVID-19 activities:
   a. Support to faculty member who was infected with COVID-19 to write a first-person case report for publication.
   b. Completing a manuscript on the Campus Cohort investigation for submission – it will be the first report of an outbreak investigation of COVID-19 in a healthcare institution in India. (Team leading first drafting – Dr Biju Soman, Dr Gurpreet Singh (PhD student), Dr Rakhal Gaitonde.
   c. Dr Rakhal Gaitonde is part of the team writing a conceptual framework of COVID-19 control activities to be submitted for upcoming COVID special issue of IJPH.

3. Projects initiated related to COVID-19 by AMCHSS:
   a. Dr Mala Ramanathan - 'Primary Health Care Preparedness and LSGI response in the context of COVID-19 in Kerala'. This study is being undertaken with the collaboration of the Director, Kerala Institute for Local Administration, Trissur.
   b. Dr Rakhal Gaitonde. Innovations during COVID-19 pandemic in India: A repository. Project submitted to ICMR. Status – Approved by National Task Force.

C. HOSPITAL WING

The faculty of hospital wing and AMCHSS under the leadership of the Director swung to action mode needed for patient and staff protection as soon as the crisis set in with the diagnosis of COVID-19 in a member of the faculty. The communications between the staff was done mainly via digital conferencing since a sizeable number of the personnel in different departments were sent to home quarantine. The remaining non-quarantined staff was on duty duly following the guidelines regularly updated by the government and the COVID-19 cell headed by the Director.

Orders and advisories issued & Various response actions

Manuals and practice guidelines were prepared by all departments for the management of outpatients, emergencies and inpatient care to tackle COVID-19 pandemic. Furthermore, specific guidelines for triaging patients into high, intermediate and low risk or no risk categories were also prepared using MOHFW, WHO and various international professional societies' recommendations to guide the institute's admission policy, transport of patients and treatment.

Doctors and Nurses of all the departments participated and prepared the COVID-19-specific Infection Control Manual of SCTIMST under the guidance of department of Microbiology.

The Basic Sciences and Para Clinical Departments such as Biochemistry, Microbiology, Pathology and Cellular Molecular Cardiology chipped in with various activities to control COVID-19 on the timelines mentioned. The computer division gave invaluable support with prompt organization of multiple video conferencing, creation of COVID-19-specific web pages, updating the software for teleconsultations and online examinations. Further, it created new modules for COVID-19-specific purchases and store items and SMS services to inform the staff and students on quarantine.

Measures and Safety Precautions in the OPD

- Queuing at entrance area is discouraged and token numbers are issued to patients by security personnel. They are advised to be seated at the waiting areas maintaining social distancing until their turn comes (Figure 3).

Figure 3: Social distancing by patients

- Entry of the patients is regularized and a staggered system is followed.
- Facility for hand washing with soap and hand sanitizers are provided at the entrance to the OPD (Figure 4).
- Patients and bystanders are advised to wash their hands and wear facemask properly before entering the hospital. Masks are provided if required.
- All staff at OPD area is wearing required preventive equipment like mask, gloves and also using hand sanitizers or washing hands with soap frequently. In addition, facial visors are used by doctors and nurses during patient interactions.

Figure 4: Hand washing facilities with soap and hand sanitizers at hospital entrance

- Security personnel conduct temperature screening with thermal scanner, at the entrance. All patients, bystanders, visitors to various departments and staff members are screened.
- Next level of screening is done using a proforma for COVID-19 screening by the Medical Social worker in the Patient Management Services.
- If any of the checklist question is positive, the patient is directed to triage area and will be communicated to concerned OPD (Figure 4). The concerned doctor will examine the patient at the triage area with all preventive precautions like PPE. Hotspot notifications in the intranet were reviewed on a daily basis and the patients from these areas were also triaged.

Figure 4: Triage area

- Sick/Ambulance patients are also attended as per protocol.
- Disposal/admission of the patient is done fast.
- Structural modification has been done at Information Centres and OPD Nursing station by fixing glass partitions.
- Chairs are rearranged near the OPD and outside waiting areas to ensure social distancing.
- Only one bystander is permitted to visit the patient during visiting hours.

Measures and safety precautions in the Inpatient Department

Separate area have been demarcated in all inpatient areas for COVID-suspected patients in all admitting departments. Furthermore, special COVID Isolation facilities have been created in one block of the hospital to take care of critically ill patients:

- Division of Clinical Engineering converted the existing Neuro-medical Ward to COVID-19 Isolation Ward by providing additional medical gas outlets including oxygen, air and vacuum ports, Electrical work done for accommodating additional patient monitors, ventilators, etc., Air-conditioned the entire area and provided exhaust outlet for increasing the air changes to reduce the risk of COVID-19 spread through aerosols.
- Converted the Neuro Medical ICU into a negative pressure isolation ICU by re-designing and installing suitable exhaust blowers with filters.
- Separate entrance/exit and areas were made for donning and doffing of PPE for managing sick COVID-19 patients.
- Conversion of Congenital Heart ICU into a negative pressure isolation room by re-designing and installing suitable exhaust blowers with filters.
- Additional options were installed in selected Adult Cardiac surgical and Neuro surgical OTs for switching between positive and negative pressure to meet the infection control requirements to reduce the impact of aerosol generating procedures-induced COVID-19 transmission.

- ❖ Most of the critical equipment were serviced and repaired to meet the COVID-19 emergencies. Extra preventive maintenance was done for making the equipment ready to meet the emergencies, since most of the equipment were idle during the lockdown period.
- ❖ Critical Air Handling Units rooms and CT room were installed with UVC germicidal UV tubes for reducing the aerosol infections (Figure 6).

Figure 6: CT room with installed UV lights

- ❖ Disinfectant, face mask, N 95 masks, COVID guard face shield, gloves, and PPE kits were made available for all staff according to guidelines.
- ❖ Standard operating procedures (SOPs) were placed in SCTIMST intranet after approval by COVID-19 cell for everybody's information.
- ❖ New protocols for periodic checking of critical care equipment during lockdown period were developed by the Division of Clinical Engineering.
- ❖ Procurement of essential spares and consumables were done in order to manage the epidemic/pandemic outbreaks and lockdown conditions.

Furthermore, focussed guidelines and protocols were formulated for the safety of the staff and patients undergoing diagnostic procedures such as echo, ultrasound, CT, X-ray, DSA, MRI, ECG, EEG, EMG etc. For example, Echo was modified in two ways:

i) Plastic sheet screens were kept between the patient and the operator with transparent plastic covers. Holes in the proper places ensured access to patient with probe (Figure 7).

Figure 7: Modification in echo lab

ii) Sono Box: Developed by the Department of Clinical Engineering of the Hospital Block, it is an enclosure inside air-conditioned echo rooms to prevent aerosols. It has UV sterilisation which is done after each patient. It is equipped with HEPA filter with negative suction which will prevent aerosol spread (Figure 8).

Figure 8: Sono Box

Training programs and communication materials

All the departments made sure that all members attended the training programme arranged by the infection control team for donning and doffing of PPE and other standard hygiene precautions.

The academic programmes were continued via digital mode using multiple apps like Zoom, Microsoft teams, Big-Blue button, Google meeting etc.

Dr Kavita Raja published a COVID-19-related article in Malayalam in Shastra Gathi, for public awareness.

Successes & Best practices

- All the departments started working during lockdown to manage the emergencies initially and then the elective work also started.
- Tele-consultation services and counselling over phone was offered during this period to reduce the stress and strain of the patients and to prevent travel.
- Two ICMR-approved COVID-19 test laboratories were set up quickly to test people or patients suspected to have contracted the infection. This facility was mainly used by the state government.
- The departments has succeeded in keeping down the stress and anxiety levels of all staff, students and patients to a minimum during the COVID-19 period by counselling and regular training classes.
- Nursing department has actively involved with the establishment of the COVID testing lab in the institute. Further, it gave training to all the staff in donning and doffing of PPE, management of COVID patients on ventilators and cleaning and waste management.
- Classes were given to relatives of patients on hand washing and use of face masks by the nursing department.
- Four-hourly cleaning in all units and 2-hourly surface cleaning for frequently touched areas such as OPDs were ensured.
- Regular rounds by infection control team and nursing officers were planned.
- Accommodation was arranged for staff in nursing hostels and a nearby hotel during the lockdown period.
- The morale among staff and students remained high.
- Online teaching was ensured to the Resident who was on quarantine due to the stipulated regulation.

- A patient from adjacent medical college COVID-19 ward was transported by the red protocol recommended by the ICT of medical college Trivandrum and SCTIMST and the necessary interventional procedure was performed on 19th May 2020 which highlights the coordination with other departments in other institutions.

IV. Initiatives by Raman Research Institute (RRI), Bengaluru

The Institute took proactive steps to respond to the emerging situations on account of COVID-19 from time to time.

1st March 2020 – The Institute stopped visits by students from schools and colleges in and around Bengaluru and elsewhere who usually visit as part of the Institute's science outreach efforts.

15th March 2020 – The Institute went into 'Work from Home' mode as per the State Government orders, which was followed by nationwide lockdown. During the lockdown, the Institute ensured that full wages were paid to the casual labour on time to provide them with financial stability. Students were advised before the nationwide lockdown to decide on their stay in hostels. Accordingly, some of the students went home. For the remaining students who were residing at the hostels, all necessary arrangements were made to ensure their safety.

27th April, 2020 – The Institute started working with minimal staff as per the government orders. All the government orders with reference to the attendance of staff were adhered to. Necessary safety precautions like Thermal scanning, Sanitizers, Hand wash, cleaning the surfaces with disinfectants were taken up as per the guidelines issued by the government.

3rd June, 2020 – Home quarantine facility for returning students along with detailed guidelines based on government quarantine norms were in place. The guidelines also included safety procedures upon arrival, food arrangements and emergency contacts.

Initiatives: The Institute is putting in place foot-operated sanitizer dispensers, foot-operated door knobs and water taps to reduce the human touch points across the campus. To continue the academic traditions of the Institute during the lockdown virtual platforms were used to hold research discussion meetings, seminars etc.

Science Communication: Theoreticians at the Institute wrote a popular article titled "Mathematical models for the spread of COVID 19: an explanation for non-scientists". This was widely shared on the Institute's social media platforms. The Institute has been sharing DST's e-newsletters - a compilation of the most relevant initiatives and efforts taken by the Government of India on COVID-19. The Institute has also been posting and retweeting COVID-19-related posts and tweets of the Honourable Minister of Science and Technology and the Department of Science and Technology.

V. Initiatives by Wadia Institute of Himalayan Geology (WIHG), Dehradun

Wadia Institute of Himalayan Geology (WIHG), Dehradun has reacted immediately after the spread of the pandemic COVID-19. Following are some of the WIHG responses in relation to the spread of the disease.

a) The Institute was to organise an International workshop on the 'Assessment and Mitigation of landslides in the Himalaya' during March 13-14, 2020. The response to this workshop from across the country and also from abroad was very good, andnearly80 researchers from India and around 7 from abroad were expected to participate. However, with the spread of the COVID-19, the Institute took an apt decision to postpone the said workshop.

b) During the early days of lockdown, the employees of the Institute along with its alumni and the retirees, contributed a respected sum and donated 100 PPE kits for the doctors and 100 Ration Kits for the needy to the state government official. This gesture was greatly appreciated and thus the state government conferred the title of '*Corrona Warrior*' to the Director, WIHG, Dr Kalachand Sain. This event was widely covered in the local media.

c) The employees of the Institute contributed a part of their salary to the PM Cares fund

d) In order to maintain the proper hygiene at low cost, the scientists and laboratory staff of the Institute have prepared indigenous sanitizer that are being used by its employees.

e) In order to understand the effects of the lockdown on the geological system of the Himalaya, particularly on the fluvial systems in the Ganga and Yamuna rivers, the Institute has initiated a study towards this. For this, samples of the river water and sediments covering the Ganga and Yamuna valleys of the Garhwal region has been collected during May 04-05, 2020. The collected water samples were analysed in the laboratory. The preliminary measurements on stable isotope composition ($\delta^{18}O$ & δD) indicate towards a dilution effect as they fall close to Global Meteoric Water Line (GMWL). Subsequent fieldwork from June 11-14, 2020 after the release of the lockdown will be undertaken to testify any compositional change in the fluvial systems.

f) The Institute has a network of automated weather stations (AWS) in the vicinity of the Gangotri, Dokriani, Chorabari and Pindari glaciers in the Upper Ganga basin and a black carbon (BC) monitoring system near the Gangotri Glacier. It is eager to assess any change in the atmospheric concentration of BC during the lockdown period and the anthropogenic activities, and this will be assessed in the high altitude field season that will start soon.

g) In addition, the Institute honestly followed all the advisory and guidelines of the state government and the Ministry of Health & Family Welfare and the Ministry of Home Affairs, issued from time to time.

VI. Initiatives by National Innovation Foundation

1) National Innovation Foundation – India (NIF), an autonomous institute under the DST has come up with a call inviting innovative citizens to participate in its Challenge COVID-19 Competition (C3).

2) Interested innovators are welcome to participate with their creative ideas and innovations for problems or issues like reducing transmission of Coronavirus through original creative ideas, innovations, which can supplement the efforts of the government in slowing or eliminating the spread further, innovative ideas which can make activities like sanitizing one's hands, body, and home items etc.

3) Ideas are also invited for gainful engagement of people at home, healthy food for nutrition and boosting immunity especially at the time of lockdown when raw materials are limited, (Personal Protective Equipment) PPE's and rapid diagnostic testing facilities for capacity building of healthcare and other areas.

VII. Initiatives by Survey of India

1) DST has created an Integrated Geospatial Platform out of available geospatial datasets, standards-based services, and analytic tools to help decision making during the current COVID-19 outbreak and aid devising area-specific strategies to handle the socio-economic impact in the recovery phase.
2) The platform is initially expected to strengthen the public health delivery system of the State and Central Governments and subsequently provide the necessary geospatial information support to citizens and agencies dealing with the challenges related to health, socio-economic distress, and livelihood challenges.
3) The mobile application SAHYOG as well as the web portal (https://indiamaps.gov.in/soiapp/) prepared and managed by the Survey of India (SoI) has been customized to collect COVID-19-specific geospatial datasets through community engagement to augment the response activities by Government of India to the pandemic.

VIII. Initiatives by Technology Information, Forecasting and Assessment Council (TIFAC)

1) The Technology Information, Forecasting and Assessment Council (TIFAC) released a White paper on 'Focused Interventions for 'Make in India': Post COVID 19'. The White Paper captures sector-specific strengths, market trends, and opportunities in five sectors, critical from the country's perspective that includes, healthcare, machinery, ICT, agriculture, manufacturing, and electronics with reference to supply and demand, self-sufficiency and mass-scale production capacity.
2) It has identified policy options primarily in the areas of Public health system, MSME sector, Global relations: FDI, recalibrated trade alignments, new-age technologies, etc.
3) This is important for the development of technology clusters in champion segments, creating Technology Start-up Exchange, identifying, supporting, and piloting ten blockbuster technologies and collaborating with new dynamics with incubators of Israel and Germany, towards promoting import substitution as well as evolving technology platforms in sunrise technologies.
4) The recommendations are directed towards giving immediate technology and policy impetus to make India "ATMANIRBHAR". Based on the linkages and interdependencies between the outputs of different sectors, output multiplier and income multiplier for various sectors have been presented in the paper.

IX. Initiatives by Centre for Nano & Soft Matter Sciences (CeNS)

a. Comfortable face mask designed by CeNS could encourage public to use it for long hours

A team of researchers at Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, an autonomous institute of the DST, have developed a cup-shaped design (patent filed) of the mask that helps to create enough space in front of the mouth while speaking. It has been transferred to a Bangalore-based company for mass production.

This snug-fit mask causes no speech distortion, no fogging on glasses, and indeed packs well all around, leaving practically no room for leakage while breathing. Another important advantage is its high breathability allowing one to wear it without any discomfort. Further, the researchers have chosen the fabric layers such that there is a possibility of deactivating pathogens sheerly by the electric charges that may prevail under mild friction due to the triboelectric nature of the fabric. These advanced-level tests are being carried out.

With the increase of active COVID-19 cases in India and other countries, usage of face masks has been advised for the general public. While the healthcare professionals can use the special and high technical quality medical masks, for the general public, a mask with moderate filtering efficiency should suffice. It should be comfortable to wear so that people get motivated to wear it for long hours.

CeNS has transferred this technology to Camellia Clothing Ltd., a Bangalore based garment company, established a couple of decades ago. The company wishes to produce and sell around one lakh mask per day through different distribution channels throughout India.

b. CeNS uses electrostatics of materials to develop Tribo E mask to protect healthy individuals from COVID-19

Face masks used by frontline healthcare professionals, which are of high technical quality, need special expertise for production, while a simple face mask that can contain the spread of the Coronavirus is advised for the general public.

Such a mask, though rudimentary in its action for containing the viral diffusion across the fabric layer, is expected to reduce the transmission of micro-droplets that linger in the air even during a simple conversation, let alone sneezing. Simple, often homemade ones, are advised for healthy individuals rather than those meant for health workers as there is limited supply of the latter. If only the choice of the fabric can be made intelligently, the mask can serve the purpose more efficiently.

A team of researchers at the Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, an autonomous institute of the DST, have come up with a recipe for making face masks, termed as Tribo E Mask, that can hold electric charges to restrict the entry of infections but interestingly, without any external power.

The innovation by Dr Pralay Santra, Dr Ashutosh Singh, and Prof Giridhar U. Kulkarni relies on electrostatics. When two non-conducting layers are rubbed against each other, the layers develop positive and negative charges instantly and continue to hold the charges for some time. They have used this electric field, quite strong at proximity, to deactivate or possibly even kill the germs.

The mask is three-layered – a layer of nylon cloth sandwiched between polypropylene layers, the latter sourced from commonly used non-woven grocery bags. In place of nylon, silk fabric from an old saree or shawl may also be cut and used. When layers are rubbed against each other, the outer layers develop negative charges, while the nylon will hold the positive charges. This will act as double electric wall protection against the infectious entities crossing. As the mask is made out of commonly available fabrics, it can be washed just like any other cloth and can be reused. At this stage, the mask is, however, not recommended to healthcare professionals and patients.

Tribo E mask

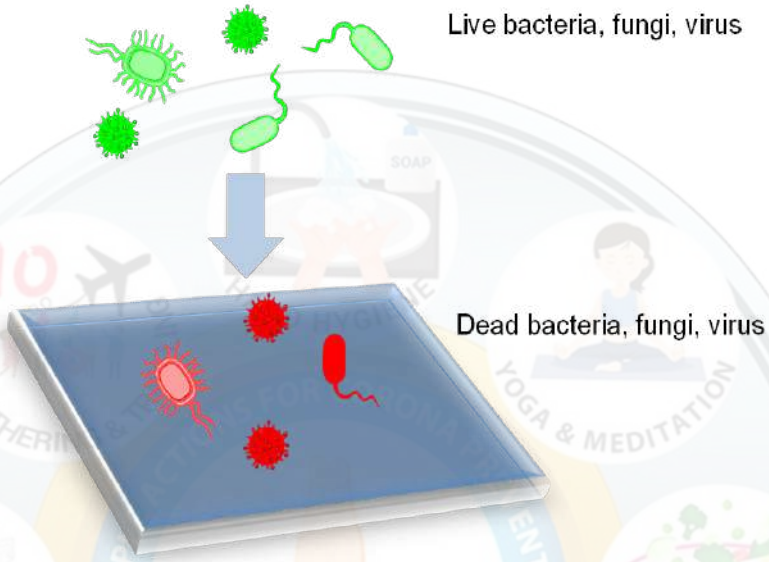
X. Initiatives by JNCASR

a. JNCASR develops versatile coating to stop spread of viruses like influenza and COVID-19

An antimicrobial coating, developed by Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, an autonomous institute under the DST, has shown excellent results in tackling the spread of deadly influenza virus, the root cause of severe respiratory infections, by inactivating large loads of influenza virus. The Science and Engineering Research Board, a unit of the DST, is supporting the further development of this coating for the country's war against COVID-19.

The proven efficiency of the coating in 100% destruction of influenza virus (an enveloped virus) shows that the coating may be effective in destroying COVID-19 – another enveloped virus upon contact. The technology which is simple and hence do not require skilled personnel for its development is already set to be tested against COVD-19. If found to be active, a number of PPEs, such as masks, gowns, gloves, face shields, used by doctors and nurses can be coated with it, imparting enhanced protection and safety to them. This will aid them to fight the battle against COVID-19 more effectively.

The technology has been developed by Prof. Jayanta Haldar's group at JNCASR including Mr. Sreyan Ghosh, Dr Riya Mukherjee and Dr Debajyoti Basak. The compound that the scientists have synthesized for the coating is soluble in a range of solvents such as water, ethanol, methanol and chloroform. Aqueous or organic solutions of this compound can be used to coat different daily-life and medically important materials, such as textiles, plastic, PVC, polyurethane, polystyrene, in a single step. The coating displays excellent antiviral activity against influenza virus completely killing them within 30 minutes of contact. It disrupts the membranes of pathogens (i.e., bacteria) leading to their death.



Antimicrobial coating on surfaces

During the research, the coated surfaces also completely killed different drug-resistant bacteria and fungi such as methicillin resistant *S. aureus* (MRSA) and fluconazole resistant *C. albicans* spp, respectively, most of them within 30 to 45 minutes, thus displaying rapid microbicidal activity. The cotton sheets coated with the compound showed complete killing of more than a million bacterial cells.

Molecules have been designed to achieve optimum solubility in a wide range of solvents using a cost-effective three- to four-step synthetic approach with easy purification and high yield. Besides, the coating can be fabricated on a variety of surfaces with ease, and simplicity of the technology eliminates the necessity of skilled personnel for its development.

b. Launch of a COVID Diagnostic Training Centre at JNCASR

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), has established a state-of-the-art COVID Diagnostic Training Centre at its Jakkur campus to help build capacity for the national fight against COVID-19 pandemic.

Molecular diagnostic techniques, such as the real-time PCR, play a crucial role in the diagnosis and tracking of epidemics, including COVID-19. Unfortunately, India lacks personnel skilled in and adept at performing a real-time PCR in clinical diagnostics. Appreciating the crucial and unmet needs of the nation, JNCASR has embarked upon a campaign by establishing a state-of-the-art diagnostic training facility to train personnel in a real-time PCR for COVID-19. The primary objective of the programme is to train multiple batches of trainees, 6-10 trainees per batch, in real-time PCR.

The programme envisages training people in multiple and sequential batches over the coming months through crash course spanning over a week. The first batch has undergone training from June 16 to 22, 2020, at COVID Training Facility, JNCASR.

The comprehensive crash-course spanning over a week comprises of both classroom lectures and laboratory experiments. The course is designed to impart theoretical knowledge as well as hands-on training. The practical laboratory sessions have taught the participants the processing of infectious samples, nucleic acid extraction and preservation, real-time PCR and other molecular techniques, data analysis, and, most importantly, standard operating protocols (SOPs) of a clinical diagnostic facility. Only simulated samples, not containing an infectious virus, has been used for training. Following the course, the trainees will be well-positioned to join a clinical diagnostic facility and handle samples in a clinical setup and perform a real-time PCR for not only COVID-19 but any infectious organism.

The programme is open for young candidates with a graduate or post-graduate degree in medical laboratory testing (MLT degree) offered by any medical institute in India. Personnel currently engaged in clinical service and diagnostic laboratories are especially encouraged to apply for the training. Registered personnel are offered a suitable remuneration in addition to free boarding and lodging by the institute.




c. A predictive model by JNCASR can help prepare for medical needs for COVID-19

A team of researchers from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under the DST, along with collaborator from IISc Bengaluru have developed a heuristic predictive model for COVID-19 that provides short-term predictions about the evolution of the disease and the medical needs that are generated as a consequence.

The model focuses on the 'Achilles' heel' of COVID-19 response – medical inventory management. By providing key figures for medical inventories such as PPEs and ventilators, this model can greatly aid a systematic and meticulously planned response to the pandemic. It will provide a full layout of the medical inventory needs, including intensive care, acute care, and medical supplies requirements, district-wise, for the coming weeks. It will also provide a pan-India overview of the development of the pandemic, but also a state and district-level insight into its progress.

This research is under review, and a version is available in the public domain at medRxiv. The work was carried out by Prof. Santosh Ansumali and Dr Meher Prakash from JNCASR along with Prof. Aloke Kumar from IISC as an initiative of the office of the Principal Scientific Advisor to Government of India along with Prof P. Sunthar, IIT Mumbai and a team from AFMC Pune led by Lieutenant General (Dr) Madhuri Kanitkar. The initial motivation for the work was a request from the Caring Indians team, which is a crowd-sourced response to the pandemic. When this crowd-sourced project started, a key question was what will be India's projected need for critical medical supplies such as PPEs, ventilators, and so on.

Responding to the question, the team assessed that most modelling and forecasting work for COVID-19, focusing on India, was clustered around the popular epidemiological models like Susceptible-Infected-Recovered (SIR) model. These models have a serious shortcoming because many aspects of the disease are yet unknown, and models were proceeding with 'educated guesses' on key parameters. However, they realized that in many nations, COVID-19 evolution had key similarities, and as these nations were ahead in the curve, these key similarities could be exploited for predictive heuristics -- allowing rapid calculation of disease evolution.

Prof. K.R. Sreenivas, Chairman, Engineering Mechanics Unit, JNCASR, says that the adoptive model is successful in monitoring the progression of the disease and is handy for planers to mitigated COVID-19 crisis in India.

According to Dr M. Vidyasagar, FRS, National Science Chair and Distinguished Professor the predictive model for the progress of COVID-19 developed by Profs. Ansumali and Kumar is quite novel and has wider applicability than almost any other existing model. The model can help Indian authorities to get accurate projections of the requirements for critical resources such as ICU beds, ventilators, and the like.

XI. Initiatives by International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI)

a. ARCI develops UVC-based multipurpose disinfection cabinet for containing surface contamination of COVID-19

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous R&D Centre of the DST, and MEKINS Industries have co-developed a UVC-based Cabinet for disinfecting non-critical hospital items, laboratory wear, and PPEs in the research laboratories to prevent surface contamination by SARS-CoV-2.

It can also be used to disinfect items exhibited to customers in commercial establishments and several domestic items.

India was successful in controlling the spread of COVID-19 caused by the SARS-CoV-2 virus during the first few phases of lockdown due to strict implementation of COVID-19 guidelines. But, with relaxation of the lockdown, there is a chance of slow spread of disease due to the movement of people across the country, and this is predicted to continue for some time. Transmission through surface contamination is an unpredictable risk in which common utilities play a key role.

The best way to deal with this transmission is by a dry and chemical-free rapid disinfection through exposure to UVC light. UVC irradiation with 254 nm is strongly absorbed by RNA part of SARS-CoV-2, leading to molecular structural damage via a photodimerization process and thus inactivating it. UVC exposure is the best known methods to disinfect virus-prone objects, including stethoscopes, blood pressure measuring equipment, patient care items, mobile phones, wallets, laptops, reusable laboratory gloves, lab coats, micropipettes, smaller measurement equipment, papers and so on. As the extent of disinfection is proportional to the UVC dose received by a contaminated surface, designing a UVC system with proper engineering is very critical to get the best results.

A compact UVC disinfection cabinet co-developed by ARCI and MEKINS, a Hyderabad based company, consists of 4 UVC lamps of 30W (on sides) and 2 lamps of 15 W (top and bottom). It gives a flux sufficient to disinfect articles of various dimensions placed in shelves separated by metal grilled frames to allow sufficient light from all sides. For the safety consideration and to avoid direct exposure of UVC light to the user, the lamps switch on only when the door is locked. The irradiance intensity is measured at various points within the box to assure sufficient radiation to disinfect all the placed articles within 10minutes. The partition frames in the cabinet are removable so that even bigger objects like lab coats, blazers, suits can be disinfected when required. The UVC cabinet is multifunctional and very promising for establishments including research and academic institutes, corporate offices, hospitals, clinics, nursing homes, hotels, restaurants and other commercial establishments, including domestic usage for fighting COVID 19.

b. Hand sanitizer prepared by ARCI provided to police personnel on duty during COVID-19 crisis

Considering the scarcity of hand sanitizers in the market, International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad, an autonomous R&D Centre of the DST, has produced hand sanitizer as per the WHO standards and distributed it

among police personnel in Hyderabad, students, and staff of the institution. A team of scientists, students, and staff voluntarily came forward and produced about 40 litres of sanitizer.

The entire idea of production, packaging, and distribution was completed in just 6 hours. Meanwhile, the order of lockdown was announced, and many of the students were leaving for their home towns. For their safety, a bottle of hand sanitizer and a face mask was given to most of them who were traveling. The sanitizer was also distributed to all the security staff, people working in the canteen, scientists, and also placed at common areas and entry gates. Team spirit, desire to contribute in disaster management, care, and concern about the ARCI family made this possible within a very short time.

Subsequently, given the risk being taken by the police personnel who are working relentlessly to enforce the social distancing, ARCI Director Dr G Padmanabham directed the team to increase the preparation of sanitizer so that it can be distributed among them. Accordingly, a substantial quantity of sanitizer was prepared and handed over to Shri Sunpreet Singh, DCP, Rachakonda Commissionerate by ARCI's Senior Scientist Dr R Vijay.

The Deputy Commissioner of Police, while appreciating the support extended by the scientists, requested for more quantity to provide for as many personnel as to possible. ARCI has made all arrangements to produce large quantities of sanitizer and provide it in easy-to-dispense 100 ml bottles, which the police personnel can easily carry with them in their pockets. Each bottle could last more than a week for each police personnel.

Dr Padmanabham conveyed his appreciation to all the team members who contributed to this effort and encouraged them and other scientists to come up with more ideas to fight COVID-19.

In order to stop the spreading of dangerous corona virus, it is recommended that hands, staircase railings, door handles, "IRIS" biometric machine keys, common equipment, office vehicles are to be cleaned by sanitizer.

The team that made 40 litres hand sanitizer within a few hours

Dr R. Vijay handing over the hand sanitizer bottles made at ARCI to Shri Sunpreet Singh, DCP, Rachakonda Commissionerate

XII. Initiatives by Vigyan Prasar

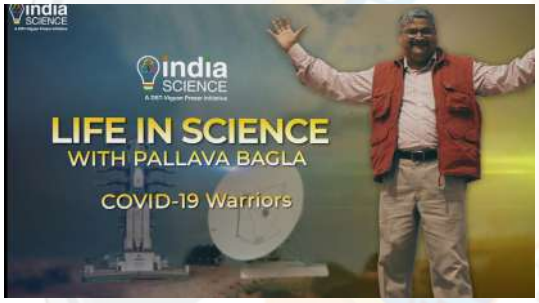
India Science Channel

India Science is an Internet-based Over-The-Top (OTT) Science TV channel. It is an initiative of the DST, implemented and managed by Vigyan Prasar (VP), an autonomous organisation of the DST. This 24x7 video platform is dedicated to science and technology knowledge dissemination, with a strong commitment to spreading scientific awareness, especially with Indian perspectives, ethos and cultural milieu. The initiative is supported by National Council of Science and Technology Communication (NCSTC), DST.

Science and Technology are the main driving forces of the nation and fundamental to progress and growth. So, advantages of science and technology must reach all sections of the society through popular media of communication. India's large Internet user base of 500 million is split between 305 million urban Indians and 195 million rural Indians, all of whom need to be reached with authentic science and technology content. And to do so, the Internet is fast becoming the most accessible and preferred media for content delivery.

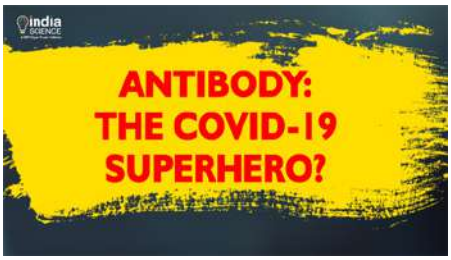
Since the occurrence of COVID-19, India Science has been working tirelessly to connect with the people, in the form of regular bulletins, documentaries, interviews, bytes and live sessions of scientists, doctors, experts, science administrators and policymakers. The following is a brief of the information products produced by India Science.

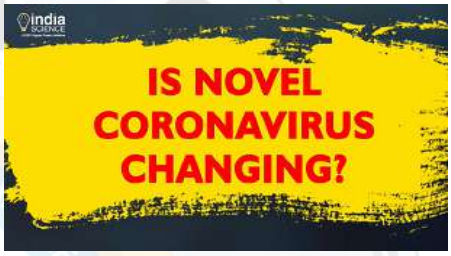
1. Daily video bulletin in Hindi and English;
2. COVID-19 Explained - Short films to explain research project findings in layman's lingo;
3. Interview of top experts from MoST institutions; and
4. Facebook live sessions on interviews of various stakeholders and media with DST Secretary.



India Science did the live webcast of National Technology Day event on 11th May, 2020. The Union Minister of Science & Technology, Earth Sciences and Health & Family Welfare, Dr Harsh Vardhan, addressed a Digital Conference, 'RE-START – Reboot the Economy through Science, Technology and Research Translations', which was organised to celebrate the National Technology Day. In his address, Dr Harsh Vardhan said that India's fight against the COVID-19 is moving ahead strongly and steadily. The Conference was organised by the Technology Development Board (TDB), a statutory body of the DST, and Confederation of Indian Industry (CII). Dr V K Saraswat, Member, NITI Aayog, Professor K. Vijay Raghavan, Principal Scientific Advisor to the Government of India, Professor Ashutosh Sharma, Secretary,

DST, Dr Saumya Swaminathan, Chief Scientist, World Health Organisation, Mr Chandrajit Banerjee, DG, CII, Dr Neeraj Sharma, Secretary, TDB also addressed this conference.





Vigyan Prasar also did the webcast of two special talks on 'Combating Coronavirus Through Technology' , on the National Technology day. The speakers were Prof. B. S. Murty, Director, IIT Hyderabad and Dr Anurag Agrawal, Director, CSIR-Institute of Genomics and Integrative Biology.

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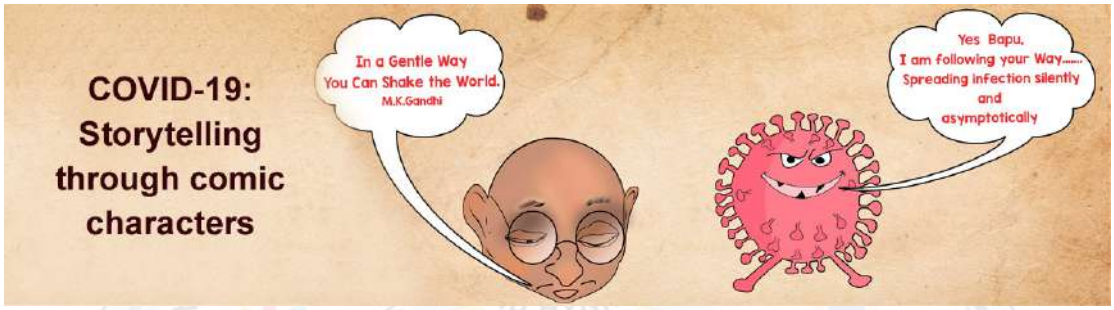
Vigyan Prasar also did the webcast of special talks on 'Scientific Social Responsibility'.

Contact info: kapil@vigyanprasar.gov.in

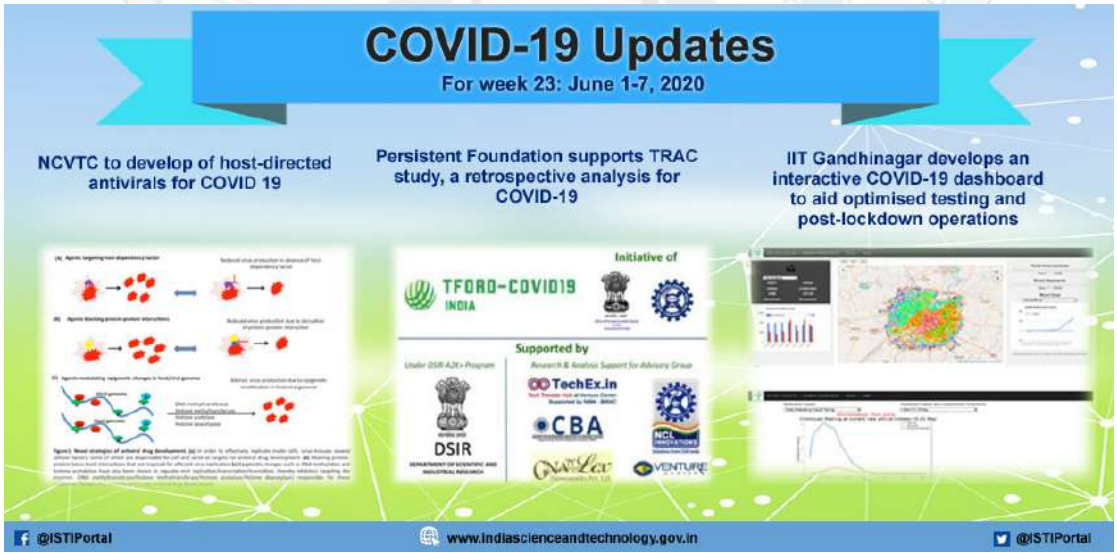
Website link:
https://www.indiascience.in/

India Science, Technology and Innovation (ISTI) Web Portal

The India Science,Technology and Innovation Portal (ISTI) is a one-stop window for information about developments in India on science, technology and innovation. The portal focuses on bringing all stakeholders and Indian STI activities on a single online platform; helping efficient utilisation of resources; highlighting functioning of scientific organisations, laboratories and institutions; aggregating information on science funding, fellowship & award opportunities spanning from school to faculty level; pooling together conferences, seminars and events; and projecting science in India with its major achievements.



In the critical times of outbreak of COVID-19 pandemic, the web portal serves as a one-stop online information guide to bring together a collection of resources in response to the COVID-19. These resources are generated by efforts made by numerous initiatives and schemes taken up by several Departments and Ministries of Government of India. These are being implemented by public-supported research institutions in India. The content presented here relies on the best available scientific understanding of the disease and its transmission.




COVID-19 Updates
For week 24: June 8-14, 2020
DRDO-DIAT develops a Microwave sterilizer to disintegrate Coronaviruses
Living with COVID-19: A guide to New Normal
DST releases information brochure on health & risk communication programme focusing on COVID-19
ATULYA
COVID-19 PANDEMIC: A GUIDE TO NEW NORMAL : LIVING WITH COVID-19
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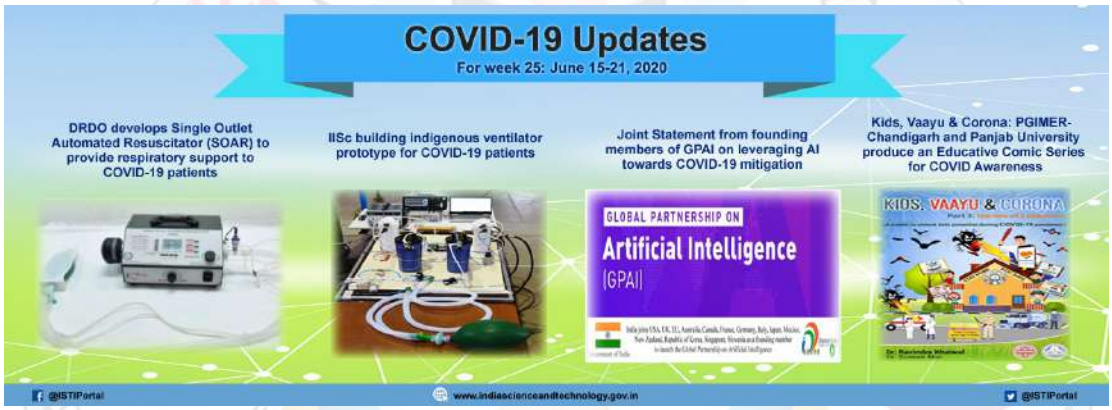
COVID-19 Updates
For week 25: June 15-21, 2020
DRDO develops Single Outlet Automated Resuscitator (SOAR) to provide respiratory support to COVID-19 patients
IISc building indigenous ventilator prototype for COVID-19 patients
Joint Statement from founding members of GPAI on leveraging AI towards COVID-19 mitigation
Kids, Vaayu & Corona: PGIMER-Chandigarh and Panjab University produce an Educative Comic Series for COVID Awareness
GLOBAL PARTNERSHIP ON
Artificial Intelligence
(GPAI)
KIDS, VAAYU & CORONA
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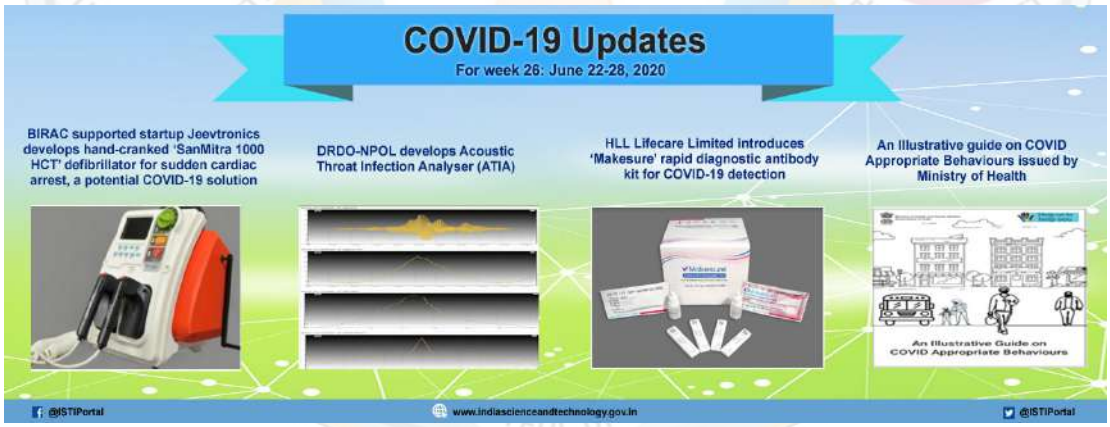
COVID-19 Updates
For week 26: June 22-28, 2020
BIRAC supported startup Jeevtronics develops hand-cranked 'SanMitra 1000 HCT' defibrillator for sudden cardiac arrest, a potential COVID-19 solution
DRDO-NPOL develops Acoustic Throat Infection Analyser (ATIA)
HLL Lifecare Limited introduces 'Makesure' rapid diagnostic antibody kit for COVID-19 detection
An Illustrative guide on COVID Appropriate Behaviours issued by Ministry of Health
An Illustrative Guide on COVID Appropriate Behaviours
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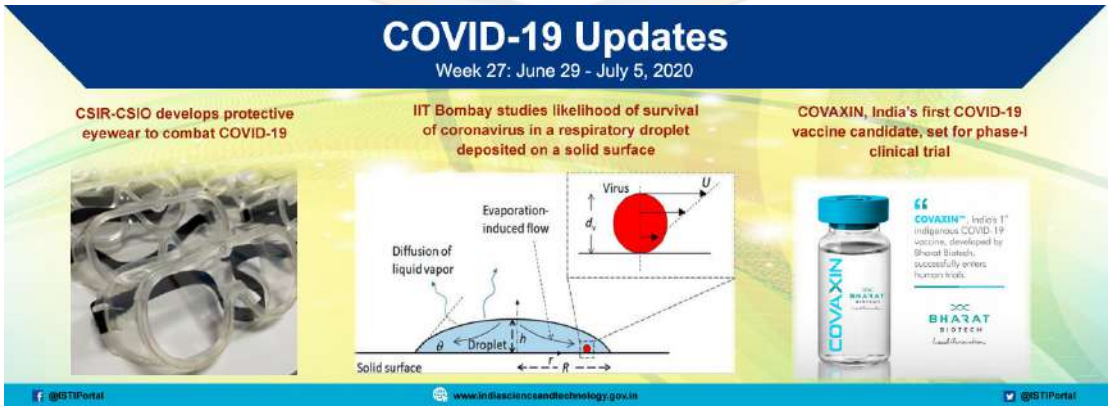
COVID-19 Updates
Week 27: June 29 - July 5, 2020
CSIR-CSIO develops protective eyewear to combat COVID-19
IIT Bombay studies likelihood of survival of coronavirus in a respiratory droplet deposited on a solid surface
COVAXIN, India's first COVID-19 vaccine candidate, set for phase-I clinical trial
Virus
Evaporation-induced flow
Diffusion of liquid vapor
Droplet
Solid surface
COVAXIN
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The web portal provides all information related to COVID-19, its presentation of symptoms, transmission modes and mechanisms, and various models of protection of individuals, healthcare professionals and prevention from spreading to the community. The reasons, usefulness, and impact of social distancing have been communicated in an easy-to-understand manner. Till date, more than 2000 science stories on efforts and initiatives taken up to combat COVID-19 have been updated, along with many awareness material and enumerable infographics.

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For more information, visit: http://www.indiascienceandtechnology.gov.in/

E-Newsletter on S&T Efforts in India on COVID-19

The COVID-19 pandemic has been unleashing a human development crisis. On some dimensions of human development, conditions today are equivalent to levels of deprivation. The crisis is hitting hard on all constitutive elements of it: economy, health and education. Most of the current strategies to reduce the risk of SARS-CoV-2 transmission are based on controlling interactions between humans, including case isolation, tracking patient contacts and screening passengers crossing borders. The pandemic has posed one of the biggest challenges to the entire humanity. In the wake of its outbreak, our lives have changed in ways we had never imagined before.

In these critical times, access to authentic information is of paramount importance. Vigyan Prasar has been covering the pandemic since the early days with the science communication perspective, ensuring that science and safety are the primary focus. For the benefit of the stakeholders and target audience, Vigyan Prasar is preparing and publishing compilation of the most relevant initiatives and efforts taken by the Government of India through its various Science Ministries, Departments, and Funding organizations, in the shape of daily, weekly, and now fortnightly e-Newsletter. These research-driven and technology-based interventions have been initiated on war footing to fight out the outburst of the pandemic.

The pandemic was superimposed on unresolved tensions between people and technology, between people and the planet, between the haves and the have-nots. These tensions were already shaping a new dimension of inequalities pertaining to enhanced capabilities and the new necessities of the 21st century. But the response to the crisis carries the potential to shape strategies on how those tensions can be addressed and how inequalities in human development are reduced. We hope this initiative of Vigyan Prasar shall be a handy guide to scientists, researchers and scholars, especially those who are interested in knowing various aspects of COVID-19 and contributing to the coronavirus warfare and making the nation Aatmanirbhar.

There have been a total of 32 editions published till 31st October 2020, with following details:

i. Daily Editions: Considering the need of immediate requirement of taking science to people, Vigyan Prasar initiated publishing the e-Newsletter on everyday basis during April 2020. There were ten editions published during the month.

ii. Weekly Editions: From late April 2020, the newsletter publishing frequency was made as weekly. A total of 15 editions of weekly newsletter were published during April to July 2020.

iii. Fortnightly Editions: From August 2020, the newsletter publishing frequency was made as fortnightly. Seven editions of fortnightly newsletter was published during August to October 2020.

iv Special Editions: Four special editions of newsletter have been published so far with following details.

a. 9th July 2020 – Consolidated Issue
b. 15th August 2020 – Independence Day Special-I
c. 31st August 2020 – Independence Day Special-II
d. 25th October 2020 – Initiatives from Office of PSA

v. Ministries & Departments covered: More than 2000 stories related to scientific interventions have been published. These stories broadly were covered from the Office of the Principal Scientific Adviser (PSA), DST, DBT, CSIR, ICMR & MoHFW, DRDO, MeitY, ICAR, MoAYUSH, and scientific & academic institutions covered, like IITs, IISc, IISERs, NIPERs, AIIMS, NITs and central universities. There were around 300 stories covered for science outreach and popularisation.

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To read individual editions, visit:
https://vigyanprasar.gov.in/covid19-newsletters/
http://www.indiascienceandtechnology.gov.in/covid-19-the-pandemic/newsletter-archive

6. Call for Proposals (CFPs) & Expression of Interests (EOIs)

DST invites short-term proposals for developing antiviral Nano-coating and Nano-based material for scale-up by industry and start-ups to combat COVID-19

- DST using the SERB portal invites ideas in the form of short-term proposals for developing antiviral nanocoating and new nano-based material for use in Personal Protective Equipment (PPE).
- The technology then can be transferred to a partnering industry or start-up for scale-up. Such nanocoatings could contribute immensely in the emerging healthcare requirements in India's fight against the COVID-19 pandemic.

- This call is for bringing the Academic groups and relevant Industrial Groups together for submitting proposals to DST's Nano Mission. It encourages multidisciplinary efforts and collaboration with industrial partners for scaling up production within a year.

Special Call under SATYAM to fight against COVID-19

- DST invites concept note under 'Science and Technology of Yoga and Meditation (SATYAM)' for the appropriate intervention of yoga and meditation to fight against COVID-19 and other similar kinds of viruses. This special call aims to provide assistance to our society in today's critical condition arises due to pandemic COVID-19. The project may address on improving immunity, improving respiratory system, stress, anxiety, depression and others.
- The concept note was to be submitted at e-PMS (onlinedst.gov.in) till 30 April 2020.

Call for Expression of Interest - 2nd Set of Products

- SCTIMST, Thiruvananthapuram an institute of national importance under the DST has developed designs and know-how for several products to combat the COVID-19 pandemic crisis.
- Sree Chitra is interested in transferring these designs and know-how to entities that can manufacture and make it available to users. Expression of Interest (EoI) is invited from interested entities for this purpose.

Expression of Interest for Developing and manufacturing Devices for the fast track Programme for COVID-19 Pandemic

- SCTIMST, Thiruvananthapuram invites manufacturers/start-ups/social groups who are interested to co-develop and manufacture medical devices on a fast track mode to support the distressing situation the epidemic COVID-19 has created for the development of Ambu bag-based Ventilator, Ventilator Sharing Kit, Battery-Operated Assistive Breathing Unit, Isolation Pods, Disposable Safety Face Shield and Deployable Field Units.

SERB invites proposals on COVID-19 & related respiratory viral infections

- SERB a statutory body of the DST invites proposals as part of special call under IRHPA (Intensification of Research in High Priority Area) scheme designed explicitly for COVID-19 and related respiratory viral infections to ramp up national R&D efforts for new antivirals, vaccines, and affordable diagnostics.

TDB invites technology proposals for fighting COVID-19

- TDB a statutory body of DST invites proposal applications from Indian companies and enterprises to address protection and home-based respiratory intervention for COVID-19 patients.
- The proposal may include technologically innovative solutions like low-cost masks, cost-effective scanning devices, technologies for sanitization of large areas as well as for contactless entry, rapid diagnostic kits and oxygenators, and ventilators.

CALL FOR PROPOSALS (CFPs) UNDER BI-LATERAL INTERNATIONAL COLLABORATIONS

Call for Proposals: Indo-U.S. Virtual Networks for COVID-19

- The Indo-U.S. Science and Technology Forum (IUSSTF) announces a Call for Proposals for COVID-19 Indo-U.S. Virtual Networks allowing Indian and U.S. scientists and engineers currently engaged in COVID-19-related research to carry out joint research activities.
- IUSSTF encourages proposals that convincingly demonstrate the benefits and value of the Indo-U.S. partnership to advance research and address critical challenges related to COVID-19.
- These network projects could be of two types: Knowledge R&D Networks and Public-Private Virtual Networks.
- Last date of submission was 15 May 2020

United States - India Science and Technology Endowment Fund COVID-19 Ignition Grants

- IUSSTEF would select and support promising joint U.S.-India S&T-based entrepreneurial initiatives that address the "development and implementation of new technologies, tools, and systems to address COVID-19-related challenges including monitoring, diagnosis, health and safety, public outreach, information and communication".
- USISTEF would also consider proposals related to technologies/products that can be re-purposed to address COVID-19 in the current scenario. USISTEF encourages projects that demonstrate a high degree of innovation leveraging advances in science and technology.
- Last date of submission was 15 May 2020.

7. Science and Society

Interventions through S&T Knowledge Organisations as Scientific Social Responsibility (SSR)

Scientific Social Responsibility (SSR) is the ethical obligation of knowledge workers in all fields of science and technology to voluntarily contribute their knowledge and resources to the widest spectrum of stakeholders in society, in a spirit of service. The most important component of SSR is about developing linkages between scientists and the society. In order to institutionalize the translation of scientific knowledge in achieving social goals the DST is working on a "Scientific Social Responsibility" policy. The main objective of SSR policy is to harness the voluntary potential that is latent in the country's scientific community to strengthen science and society linkages so as to make S&T ecosystem vibrant.

The scientific community was engaged with R&D in their own niche areas until World Health Organization (WHO) announced COVID-19, an infectious disease caused by newly discovered coronavirus, as Public Health Emergency of international concern on 30 January 2020. Indian Council of Medical Research (ICMR) then established a special unit to monitor the developments on COVID-19 to device a strategic plan to tackle the disease in India effectively. In March 2020, WHO announced the disease as Pandemic. In response, the entire scientific fraternity in India came together for the cause, and apart from their core R&D,

started to work towards the containment of disease in the country through implementation of tested protocols for disease prevention such as better hygiene and sanitation practices, social distancing and promoting immunity booster food for better health. Scientists from DST, Council of Scientific and Industrial Research (CSIR), Defense Research Development Organization (DRDO), Department of Biotechnology (DBT) and other Academic institutes took a serious note of the critical situation and as part of their SSR started working towards the immediate need of low cost Personal Protection equipment (PPE), sanitizers, masks, face shields and other direct interventions.

Initiatives for community through its Knowledge Organisations

The Science for Equity Empowerment and Development (SEED) Division, interface of S&T with society at DST primarily works towards technology led solutions to improve quality of life for enabling vulnerable sections of the society. In distressed condition of COVID-19, SEED Division urged stakeholder organizations to play a proactive role in tackling this unprecedented situation and be a part of '*India Fights Corona*' campaign. While lot of efforts are going towards combating COVID-19 through R&D, a critical situation of economic crisis is anticipated with immediate impact on livelihoods. Thus, making recovery efforts extremely challenging and need more Science, Technology and Innovation (STI)-based approach to revive the socioeconomic scar.

In response to an advisory issued by DST-SEED Division, scientists supported under various schemes and programmes through grant-in-aid mode submitted their community-based COVID-19 management action plan by tweaking the objectives within overall approved framework. The strategic action plan has been generated for *Immediate and Long-term* activities for revival of economic growth and resilience within the community.

Immediate Interventions at Field

As it is rightly said 'prevention is better than cure' and the best way to prevent and slow down transmission of COVID-19 virus as per WHO is to protect yourself and others by washing hands frequently or using an alcohol-based rub. More than 25 Knowledge Organizations in 14 States and Union Territories in India took initiatives to create awareness regarding preventive measures to avoid infection through frequent hand wash, social distancing, immunity booster foods, importance of facemasks and sanitizer as immediate action for containment of disease along with ensuring the availability of PPEs to people.

1.1 Preparation and Distribution of Sanitizer among Community

A portable bench is a complete platform that utilizes digital devices and interactive objects to sense and control the real physical world. Department of Electronics, Chandigarh University has been supported for a project to develop portable working bench for promoting learning of science (physics, chemistry and biology), mathematics, basic electronics and computing among children in minimal resource condition in rural India. In March 2020, when India started reporting COVID-19 infections, DST came forward to explore solutions to cater the immediate and long-term requirements to fight COVID-19. One of the utmost necessity was the availability of sanitizers and masks to frontline workers such as health workers, police force etc. In order to address the need, objectives of the project were tweaked and 2500 litre sanitizer was prepared under the project as per WHO guideline (Isopropyl alcohol 99.8%, Hydrogen peroxide 3%, Glycerol 98% and Sterile distilled water).

Distribution of sanitizer to distressed migratory population in and around Chandigarh, Safdarjung Hospital for health workers, AIIMS, New Delhi for Sulabh and security staff and Police Department of Haryana and Punjab

Against several odds, Chandigarh University took the initiative to deliver 500 l sanitizer and 500 facemasks to All India Institute of Medical Sciences (AIIMS), New Delhi for their security staff and Sulabh workers, 500 l sanitizer to Safdarjung Hospital, New Delhi for their medical staff. Another 200 l sanitizer was delivered to Senior Superintendent of Police, Khanna and Director General of Police, Haryana for their Police Officials, respectively. Apart from this, 1100 l sanitizer along with nutritional food was also distributed to migrant population in Chandigarh, Mohali, Gharuan and Ropar of Punjab.

Chandigarh University is currently working towards the modification of the workbench design to incorporate small sewing machine and other fittings for manufacturing masks and sanitizer using single bench. This could be amalgamated as part of interactive teaching methodology among rural students. It was decided to distribute 15 such benches to different rural locations by end of May 2020 under this project.

CSIR-National Botanical Research Institute (NBRI), Lucknow, under its SSR, developed an alcohol-based liquid herbal hand sanitizer. The young scientists of Pharmacognosy Division distributed the sanitizer to frontline warriors across Lucknow. More than 1700 l of sanitizer was distributed with the help of UP police to on-duty health workers, sanitation staff and police personals in different zones of Lucknow. The technology has been transferred to two herbal manufacturers M/s Amar Pharmaceuticals, Kanpur and M/s Fervid Health Care Pvt. Ltd., Lucknow.

हैंड सैनिटाइजर की सौंपी टेक्नोलॉजी

कोविड-19 के संक्रमण के चलते हैंड सैनिटाइजर की मांग में जबरदस्त इजाफा हुआ है। एनबीआरआइ द्वारा तैयार हैंड सैनिटाइजर की प्रौद्योगिकी एक कंपनी को सौंपी गई। टेक्नोलॉजी विकसित करने वाले फार्माकोग्नोसी डिवीजन के सीनियर प्रिंसिपल साइंटिस्ट डॉ. शरद श्रीवास्तव ने बताया कि यह टेक्नोलॉजी कोविड-19 के संक्रमण को देखते हुए बहुत कारगर साबित हो रही है। इसे तैयार करने में इस बात का ध्यान रखा गया है कि इसके इस्तेमाल से हाथों में त्वचा में सूखापन ना आए। एनबीआरआइ सीएसआइआर सोशल रिस्पांसिबिलिटी के तहत आवश्यक सेवाओं में लगे सरकारी कर्मचारियों को भी सैनिटाइजर निशुल्क उपलब्ध करा रहा है।

Distribution of sanitizer in Lucknow and technology transfer to private company

Although, there were less number of confirmed cases of COVID-19 infection in Manipur and Tripura, Manipur University and College of Veterinary Sciences and Animal Husbandry, Tripura responded immediately to the advisory issued by DST-SEED. Manipur University started creating awareness regarding health and hygiene related to COVID-19. Hand sanitizer has been prepared as per WHO guidelines for local distribution at hospitals, old age homes and vegetable sellers to maintain their hygiene. Protocol for sanitizer preparation has been shared with local NGOs and Self Help Groups (SHGs) and a dialogue with State Government was initiated to fund raw material for immediate economic thrust to these SHGs.

Sanitizer preparation as per WHO protocol at Manipur University

However, College of Veterinary Sciences & Animal Husbandry, Tripura has taken a different approach. During the lockdown period it roped in students of the college for spreading awareness related to COVID-19 and immunity boosting food as per the guidelines of Ministry of AYUSH, through telephone and social media to their family members, friends, relatives and neighbours. Use of Aarogya Setu Application, has been promoted for contact tracing for COVID-19. Information related to personal hygiene with special reference to appropriate procedure for hand washing and importance of social distancing has been demonstrated among Group D staff and security personnel. A soft copy of the pocket reference book on COVID-19 for precautions and safety measures issued by Ministry of Health and Family Welfare has also been disseminated through social media The book is being translated in Bangla for effective outreach.

1.2 Awareness Creation among Farming Community

ICAR Institutes such as Indian Institute of Maize Research (IIMR), Ludhiana; Central Institute of Fisheries Technology (CIFT), Cochin and Central Institute for Research on Goats (CIRG), Mathura associated with SEED Division have started responding immediately for the cause and started creating awareness related to COVID-19 in their adopted villages and community. IIMR, CIFT and CIRG have created WhatsApp group for creating awareness related to preventive measures, health and hygiene, importance of social distancing, symptoms and treatment facilities for COVID-19. These institutes have also promoted use of

CIRG facilitated mask making by women SHGs in villages near Mathura

COVID-19: Pandemic preparedness

[author block redacted]

Humanity is confronting a pandemic in severe acute respiratory syndrome coronavirus 2(SARS-CoV-2) caused coronavirus infection disease (COVID-19). Kashmir, like many other parts of the world is under the threat of natural calamity COVID-19 that has already engulfed many parts of the world. The recently declared pandemic COVID-19, actually the first pandemic coronavirus in the history, has created chaos around the globe affecting day to day norm, healthcare, education, travel, business and what not. Global efforts are being made to contain this emerging contagious zoonotic disease that spilled over from animal kingdom to human population and is now rapidly spreading among the masses through droplet infection or contact between healthy and infected persons. Severity of disease, lack of vaccines or specific antiviral, person to person transmission and global spread had ensured pandemic nature of the disease well before the declaration and thus raising global public health concerns.

A pandemic has four stages. Stage I represents cases imported from affected countries while the Stage II indicates local transmission from positive cases. In case of Stage III spread of disease occurs within community affecting large areas and when the disease takes the shape of an epidemic with no clear point it has reached Stage IV. Status of pandemicity varies with respect to different countries, some being at initial stage and some at peak. Countries like China and Italy have reached stage IV while as India is at stage II. Hence measures are being taken to control this pandemic or so resources is at the most stage II or III.

International agencies like World Health Organization (WHO), World Organization for Animal Health (OIE), Centre for Disease Control and Prevention (CDC, USA), European Centre for Disease Control and Prevention (ECDC), Food and Drug Administration (FDA), Food and Agriculture Organization (FAO) in collaboration with many national authorities of the affected and under threat countries and private partners are trying to draft the suitable and adaptable prevention and control strategies for COVID-19. Respective guidelines are being issued by these agencies. However with alarming levels of spread, severity and inaction, the implementation of these guidelines is proving difficult considering the constraints of local, administrative, and community issues in some countries and population and infrastructure issues in others thereby raising global concerns. Responding to community spread of COVID-19, WHO has provided interim guidance and trainings that are grouped into classes including national coordination, risk communication and community engagement, public health measures, case management and health services, infection prevention and control, surveillance, risk and severity assessments, national laboratory systems, logistics, procurement and supply management, maintenance of essential services and research and development. These measures can help to detect, test, treat, isolate, trace and mobilize the people in the response which can help in prevention of future cases and minimize entering cases and take the form of personal protective, environment, social distancing and travel related interventions. Healthcare, community and administrative settings are vital for implementation of these recommendations.

> NEED OF THE HOUR IS TO FOLLOW THE STRATEGIC PLANS LIKE APPLICATION OF 'ONE HEALTH' APPROACH INVOLVING HUMAN AND ANIMAL PROFESSIONALS, PUBLIC HEALTH PROFESSIONALS AND OTHER SCIENTIFIC FRATERNITIES TO COMBAT THE NUISANCE OF HEALTH HAZARDS LIKE COVID-19

Putting it in simpler words, quarantine of affected persons or persons coming from affected countries for fourteen days regardless of symptoms, should be followed by contact tracing of the persons that have come in contact with the affected persons or cases showing positive tests and applying similar quarantine measures. This will help in the earliest detection. Stopping of mass gatherings like closing of schools, cinema halls, not organizing public event will prevent spread of disease. Awareness through media or trainings about hand hygiene and respiratory etiquette will minimize risk. Finally preparation for pandemic involves scaling up of infrastructure, testing facility, isolation beds and mass management of positive cases which take place simultaneously. Having confirmed more than 300 cases of COVID-19 in India, the apex medical body Indian Council of Medical Research (ICMR) has set up 51 testing labs across the country where 90 samples can be tested in each lab on daily basis thus having overall capacity of testing 4500 samples. As per ICMR, there are around one lakh testing kits and additional two lakh have been ordered. However testing strategy of focusing on only symptomatic cases or cases with history of contact or travel to affected countries may not suffice. Administration in Kashmir is also taking all the necessary steps for the prevention and control of COVID-19. However relying solely on whole-of-government approach may not be sufficient for all hence society or individual based approaches need also be implemented that can help in safeguarding the people. Under the current circumstances everyone has to take steps at individual or society level for the protection of self and the society. These steps especially involve routine daily hygienic procedures at home, work or office.

Some of the basic hygiene strategies must be followed like hand washing with soap for 20 seconds or using 60% alcohol based sanitizers, using medical mask or covering mouth by tissue paper, towel, handkerchief or cloth during sneezing or coughing. Additionally, avoid frequent contact with infected inanimate objects and prefer to stay at home and maintain a distance of 1-2 meters from affected persons, avoid crowded places or travel during the times of outbreak in order to minimize the risk of transmission.

Pre-eminent method to prevent illness can be acquired through use of personal protective equipments like masks, goggles, gloves, face shield, apron, and gowns. It's important for the public to understand that healthy folks do not need to wear medical masks if not exposed to risk environment as unnecessary use of medical masks causes depletion of resources and exposes risk groups including healthcare providers to infection. Being at higher risk, older adults and those with severe underlying chronic medical condition need to take extra precautions. Society based approaches enforced by authorities though may seem hectic but are essential in the context of prevention and control of pandemic. One example is recent closure of schools by administration that was need of the hour and among the recommended protocols of the World Health Organization.

Similarly World Organization for Animal Health also called as Office International des Epizooties (OIE) endorses recommendations of the WHO and further stresses on food hygiene and environmental hygiene. During the times of outbreak, avoiding visit to infected areas, crowded places, hygienic precautions at live animal market, wet market or animal produce market, avoiding direct contact with affected animals, animals living in the market (e.g. stray dogs, cats, rodents, birds, bats) or surfaces in contact with such animals, avoiding consumption of uncooked or raw animal products (meat, milk, eggs) or contaminated food, avoiding contact with potentially contaminated animal waste or fluids on the soil or structures of shops, and market facilities and isolation of infected cases can help in prevention and control of COVID-19. As per general good food safety practices, raw meat, milk, or animal organs should be handled with care, to avoid potential cross-contamination with uncooked foods. Meat from healthy livestock that is cooked thoroughly remains safe to eat. Further there is no evidence that companion animals/pets can spread the disease. The current spread of COVID-19 is a result of human to human transmission though the initial spillover is believed to be from unknown animal source. Hence OIE recommends precautionary measures while handling companion animals especially limiting contact when sick and following basic hygienic measures.

Need of the hour is to follow the strategic plans like application of 'One Health' approach involving human and animal professionals, public health professionals and other scientific fraternities to combat the nuisance of health hazards like COVID-19. Collaboration with various platforms of print and electronic media, including social media can help in dissemination of information about these pandemic preparedness measures.

(Author is Assistant Professor, FVSc & AH, Shuhama (SKUAST-K) and is the Principal Investigator of DST/SERB Sponsored Projects on Infectious Animal Diseases)

Article published in media to create awareness and veterinary telemedicine facility initiated by SKAUST, Srinagar

Aarogya Setu and Ayurvedic Upay from Ministry of AYUSH among families of 20 farmers in village Ladhowal, Ludhiana, Punjab, 25 fishermen in Kadamakkudy Gram Panchayat, Ernakulam, Kerala and 200 goat farmers in 16 villages of Garhwal and Kumaon region of Uttarakhand, respectively. CIRG also trained 24 women SHGs in nearby villages of Mathura to stitch facemasks with the assistance of National Bank for Agriculture and Rural Development (NABARD); 10,000 masks were distributed among public. As awareness creation has a spiral effect it would accelerate the process of knowledge dissemination to others as well.

Awareness related to COVID-19 has been created through print and electronic media among residents of Busserbug and Shuhama villages, Srinagar by Sher-E-Kashmir University of Agricultural Sciences & Technology of Kashmir (SKUAST), Srinagar. Information related to importance of hand hygiene, social distancing, respiratory etiquettes, food safety and environmental hygiene during COVID-19 outbreak has been disseminated to the community. Thirty women dairy farmers in these villages have been demonstrated the use of PPE during milking process through online platforms; these farmers have also been provided masks and sanitizer. Articles on zoonotic aspects and pandemic preparedness have been published in newspaper and electronic media for public awareness. Use of Aarogya Setu has also been promoted. SKAUST took a step forward and addressed the health issues of farm animals through technology-driven platform of telemedicine.

Indian Institute of Technology, Delhi also have taken major steps towards formation of WhatsApp group for digital communication on COVID-19-related information for its adopted villages of Gaindikhata cluster, viz. Chidiyapur, GaindiKhata, Lahadpur, Norangabad, Pillipadao and Laldhang. These WhatsApp groups includes Sarpanch, Gramsevak, Tahsildar, Grampanchayat members, the youth of villages, farmers, Krishi Vigyan Kendra district officers, scientists and technicians etc. Advisory related to safe quarantine of all the migrated individuals has been communicated to Gram Pradhan Gandikhata, Haridwar, which was an extremely important step towards containment. WHO-recommended formula developed by IIT-Delhi and CSIR-NBRI for preparation of hand sanitizer have also been circulated along with the procedure to disinfect and re-use masks and gloves at household level and dispose mask and gloves. Aarogya

PROCEDURE TO DISINFECT AND REUSE MASKS AND GLOVES AT HOUSEHOLD LEVEL

Procedure	Types of Masks and Gloves	
	Surgical (Type 1,2,3); Respiratory (N95/N00/N100), & Rubber Gloves	Cloth based masks and gloves
Step 1: Preparation (Essential before you go out) Always keep a small metal utensil (use copper if available) half filled with water ready near the entrance Add 1-2 litre water + 2 spoons of detergent + 1 spoon of common salt **Caution: Don't let the utensil overflow.**	✓	✓
Step 2: To get rid of any probable source of infection that we may have carried from outside **On Entering your home,** immediately remove masks or gloves by holding the ear threads or strings with your hands; First untie lower thread followed by the upper thread. **Dip the mask/ gloves in utensil (provided in Step 1)**	✓	✓
Step 3: Hand Sanitization **Without touching your face or anything, immediately wash hands with soap for 20 seconds or sanitize with a sanitizer having 70% alcohol**	✓	✓
Step 4: Disinfection of Gloves/masks **4A. For cloth-based masks** Heat the utensil or steam in a pressure cooker Wait for it to cool. Properly rinse the dipped masks. Discard the dirty water and proceed for step 5.	✗	✓
4B. For Surgical masks or N95/N99/N100 masks or rubber or Polypropylene based gloves Heat the soap solution to make it warm (around 70°C), wait for 15 minutes, rinse thoroughly and follow step 5 and 6, OR Instead of dipping in detergent or salt, directly proceed with Step 2, followed by Steaming the Mask for 15 minutes using vaporiser or a pressure cooker by placing the utensil on a separator (may be an inverted plate or bowl to break direct contact with water while steaming)	✓	✗
Step 5: Ensure Proper drying **Put the masks/gloves for drying (preferably sun dry for 5 hours)**	✓	✓
Step 6: Reuse **Following all these steps, cloth-based masks can be used multiple times while non-cloth masks can be reused up to 4 times**	✓	✓

Important Notes: DO NOT DIP/TREAT MASKS IN HAND SANITISERS as they contain GLYCERIN, which will make them STICKY and UNFIT FOR RE-USE
SURGICAL MASKS N95/99/N100 and RESPIRATORS (TYPE 1/2/3) also contain POLYPROPYLENE fabric with GSM between 20 gm/m^2 & 25 gm/m^2, and other materials therefore, temperature should not exceed 70°C

Information related to safe disposal of used masks and disinfection and reuse of masks at household level

Setu was promoted through this group with 400 downloads through this activity. Smokeless Chulhas distributed during the on-going activities (22 chulhas distributed earlier) saved huge cooking expenses for the supported families. Mushroom activity taken up by 6 families before COVID-19 was stuck-up due to lockdown. As there was no market availability during the lockdown period online training was provided to the farmers to utilize the waste material of mushroom and convert it to compost for horticulture crops and vegetable cultivation practices.

Composting of mushroom waste and its use for cultivating vegetable and horticulture crop at Gaindikhata

1.3 Protection of Pregnant Women During COVID-19

As COVID-19 cases are increasing in the country, pregnant women are becoming anxious about contracting infection and transmitting it to their unborn child. There is a pressing need to address this challenges pertaining to Antenatal Care (ANC) amongst pregnant women. Department of Obstetrics & Gynaecology, AIIMS, New Delhi addressed this newly emerged need by creating awareness among 85 patients enrolled in SEED Division-funded project. It is not feasible for women to visit the hospital during the current times of pandemic and therefore following information related to COVID-19 is being regularly updated as push notifications; voice recordings and videos to these women since 26 April 2020.

- ❖ COVID-19 and its effect on pregnancy and baby;
- ❖ When to contact hospital for a suspected COVID-19 infection;
- ❖ Precautions if come in contact with a known COVID-19 patient;
- ❖ Precautions while communing to hospital, if suspected to have COVID-19 infection;
- ❖ Revised schedule for routine pregnancy visits;
- ❖ Revised ANC during the pandemic;
- ❖ Danger signs for contacting the hospital.

1.4 Innovating for Immediate Need during COVID-19

...तो मास्क पहनने से नहीं होगी घुटन

जागरण संवाददाता, लखनऊ: कोरोना संक्रमण से बचाव के लिए मास्क अनिवार्य किया गया है। ऐसे में पुलिस, डॉक्टर, पैरामेडिकल स्टाफ के साथ-साथ अन्य लोगों को काफी लंबे समय तक मास्क लगाने की जरूरत पड़ रही है।

कुछ लोगों को लगातार मास्क पहनने के चलते घुटन की दिक्कत महसूस हो रही है। इस समस्या से निपटने के लिए राष्ट्रीय वनस्पति अनुसंधान संस्थान (एनबीआरआइ) के वैज्ञानिकों ने हर्बल डीकंजेस्टेंट स्प्रे तैयार किया है। शुरुआती उपयोग में नतीजे शानदार मिले हैं। मास्क पहनने वालों को इससे जबरदस्त आराम मिला है। जल्द ही संस्थान जल्द इसकी टेक्नोलॉजी ट्रांसफर करेगा।

एनबीआरआइ के प्रिंसिपल साइंटिस्ट डॉ. शरद श्रीवास्तव के मुताबिक, कुछ पुलिसकर्मियों को लगातार लगातार मास्क लगाने से दिक्कत पेश आ रही थी। जकड़न व सांस लेने की शिकायत होने लगी। डीकंजेस्टेंट स्प्रे ऐसे लोगों के लिए बहुत मददगार साबित होगा। ट्रायल के तौर पर कुछ पुलिस वालों व डॉक्टरों को इस्तेमाल करने के लिए दिया गया, जिनका अनुभव शानदार पाया गया।

ऐसे उपयोग कर पाएंगे स्प्रे :

डॉ. शरद के मुताबिक, उन्होंने बताया कि औषधीय व सगंध पौधों से तैयार यह स्प्रे पूरी तरह से सुरक्षित है। इसको महज एक बार मास्क पर स्प्रे किया जाता है। इसके बाद मास्क का प्रयोग करने पर भी नासिका व श्वसन तंत्र खुल जाता है। लोगों को सांस लेने में किसी तरीके की दिक्कत नहीं होती है। इस स्प्रे को आयुष मंत्रालय की नई गाइडलाइंस के आधार पर तैयार किया गया है। संस्थान जल्द ही इसकी टेक्नोलॉजी ट्रांसफर करेगा।

एनबीआरआइ ने तैयार किया हर्बल डीकंजेस्टेंट स्प्रे • डॉ. एनबीआरआइ

खुशखबरी

- एनबीआरआइ ने तैयार किया हर्बल डीकंजेस्टेंट स्प्रे
- लगातार मास्क लगाने से आ रही दिक्कतों पर किया ईजाद

यह अपने तरीके का पहला उत्पाद है, जिसका प्रयोग कर लोग मास्क को आसानी से पहन सकेंगे। इससे जहां मास्क पहनने में तोड़े दिक्कत नहीं होगी, घुटन भी नहीं होगी।

डॉ. शरद श्रीवास्तव, प्रिंसिपल साइंटिस्ट, एनबीआरआइ

Media coverage of herbal decongestion spray

Facemasks are necessary element for protection against coronavirus contraction. However, some people, due to wearing of mask, were feeling breathing-related trouble and congestion of the respiratory tract. As it is rightly said 'Necessity is the mother of invention' this challenging issue have been taken up by the researchers at CSIR-NBRI, Lucknow to produce an herbal decongestion spray, which is a fine blend of four plant-based oils. This need-based intervention has been developed using ingredients reported in traditional scriptures based on the principles of Ayurveda.

DST has established a mechanical fabrication and 3D printing facility at Karpagam Academy of Higher Education (KAHE), Coimbatore, Tamil Nadu, under its two supported projects. These facilities were utilized during the pressing call under COVID-19 to fabricate Multi Drive Mechanical Ventilator and Face shield and Full Body Portable Disinfection Chamber. The developed ventilator has been tested by the doctors at Karpagam Medical College and Hospital, Othakalmandapam, Coimbatore and has several inbuilt features like monitoring sensors (Gas concentration, Flow, Pressure, Volume), particle filters, bacteria filters, moisture traps, gas blender, gas accumulator, inspiratory flow regulator and humidification equipment. The facility has also been utilized to make 250 face shields for doctors and medical workers at the hospital fighting against COVID-19.

Multi-drive Mechanical Ventilator and Face shield developed by KAHE

A portable full-body disinfection chamber has been developed for disinfection of personnel in the areas of controlled entry and exit to hospitals, malls, office buildings etc. The developed system has been implemented at Karpagam Medical College and Hospital. The chamber has following features:

- Sensor to detect the person at entry point;
- Sanitizer and soap dispenser;
- Electrically-operated pump (capacity up to 200 bars) for creating disinfectant mist of hypo sodium chloride;
- Automatic mist spray operation for 25 seconds;
- Roof-mounted and bottom tanks with 500 l capacity;

Portable full-body disinfection chamber developed by KAHE

- Disinfection of 500 people in single fill of disinfectant.

As suggested by the medical community, washing hands frequently can prevent spread of COVID-19 but the hand washing arrangements installed at working places with large numbers of workers itself are a potential threat for virus transmission. To address this challenge, a novel hands-free sanitizer dispenser was designed and developed. This mechanical peddle fixed hands-free dispenser for hands sanitization works without physically touching the water tap and sanitizer dispenser, thereby making it safe for usage at common places.

Apart from project-related activities, the scientific community took the responsibility to create awareness in their native villages. Dr K.P. Sridhar, KAHE, Coimbatore, started

creating awareness on COVID-19, importance of quarantine, health and hygiene in his own village, Kuttaur, Mettupalayam, Coimbatore and distributed masks to 150 villagers.

The scientists are not only innovating but also contributing their services as warriors for testing the patients. In this endeavour, the project staff at Baba Farid University of Health Sciences, Faridkot, Punjab has been diverted to COVID-19 testing lab setup in the organization. The staff underwent intensive training of 7 days at COVID-19 Viral Research and Diagnostic Lab at Govt. Medical College, Amritsar. The lab is one of the four diagnostic labs in Punjab and is duly approved by ICMR. The staff has contributed to more than 4000 RT-PCR-based COVID-19 tests.

Mechanical peddle-fixed hands-free dispenser for hand sanitization by KAHE

ICMR-approved COVID-19 diagnostic lab at Baba Farid University of Health Sciences, Faridkot, Punjab

Responding to the urgent call and advisory of DST, these S&T Knowledge Institutions stood out because of their commitment towards science, technology and its assistance to the community. These Organizations/Universities came forward to cater the immediate need with their knowledge and limited resources available at the time of need. There were several constraints like license and relevant permissions to operate during lockdown but they are aiming to serve whenever and whatever capacities. Punjab University, Chandigarh; Banaras Hindu University, Banaras and Amity University, Noida though confined due to license and administration-related issues, but have plans to create awareness related to health and hygiene in their adopted villages.

2. Long-term Interventions for Restoration of Economy and Resilience of Community during Post-COVID period.

COVID-19 is a global pandemic; however it is impacting social, health and economic systems at local level.

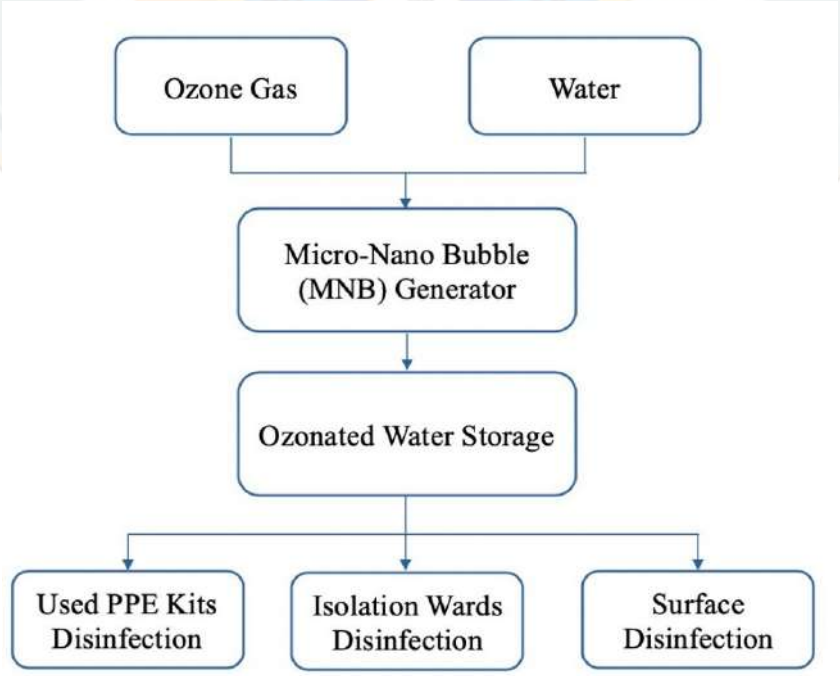
The scientific community is committed towards the war against Corona and is willing to go

an extra mile to ensure the revival of economy and societal resilience during Post- COVID-19 period. They have generated several innovative ideas and have started working towards the long-term solutions, for the benefit of the society.

2.1 Health and Hygiene

The COVID-19 outbreak has forced India to follow social distancing in community and workplace leading to societal disruptions with significant impact on mental health of people. As almost all programmes for good mental health are based on social connectivity and social support in the community. In view of social distancing and various psychosocial responses to pandemic by the community, AIIMS, New Delhi in partnership with Mental Health Foundation of India (MHFI) are planning to develop Psychological First Aid (PFA) programme for COVID-19 and similar pandemic/epidemic as an extended part of its unique initiative at Tihar Jail, New Delhi. This would minimize psychosocial problems by offering first aid techniques to the population exposed or expected to be exposed during epidemic/pandemic. PFA-E intends to address the issues related to social and physical distancing in a safe environment and have access to resources to ensure psychological wellbeing.

CSIR-NBRI, Lucknow, under its SEED supported project, is developing a plant-based synergistic natural supplement to alleviate gouty arthritic conditions, under which an extensive screening of several medicinal plants were carried out through *in vitro* models. The *in-vivo* efficacy and safety of identified leads was established and found at par with standard drug colchicine. Based on results (*in-vivo* models) several permutation and combination were prepared to identify the best synergistic combination. Best selected combination is being tested for its efficacy. The developed plant-based synergistic natural supplement is water soluble with no solvent residue and the raw materials (medicinal plants) used for preparation of combination are easily available in herbal drug market at affordable rates and do not pose any threat to the biodiversity. As movement of elderly population is confined due to lockdown during COVID-19, as per the advisory of Government of India, this natural supplement will be crucially important to improve the lifestyle of aged, elderly and compromised section of the society by restoring their locomotion.



Flow diagram of ozone-based disinfection

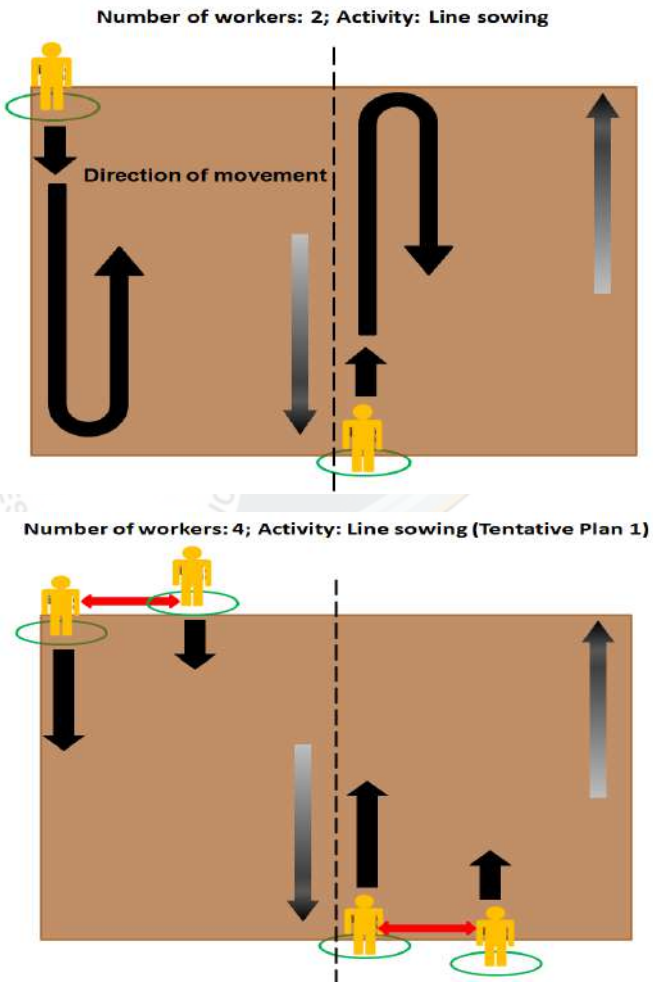
IIT–Kharagpur, as part of the DST-funded project, was working on purification and characterization of green surfactants to control mosquito and housefly. However, due to the emerged need they would be testing the efficacy of their partially purified or purified biosurfactant(s) against enveloped and non-enveloped viruses in collaboration with the Regional Virology Laboratory, AIIMS-Bhopal. A ready-to-use bio-surfactant-based formulation for the purpose of hands and surface sanitization will be developed and tested in Kharagpur municipality. This will be tested on 50 families spread across village and urban areas.

Responding to the urgency of the COVID-19, scenario, IIT-Delhi, already working on the development of the pharmaceutical formulation for CBRN (Chemical, Biological, Radiological and Nuclear) decontamination of skin, proposed to fabricate nontoxic, biocompatible and cost-effective body wipes to fight against this deadly virus. Stability studies of the proposed wipe will be conducted as per International Conference on Harmonization (ICH) and American Association of Textile Chemists and Colorists (AATCC) guidelines. Till date there is not a single formulation available in the combined form for the chemical, biological and radiological decontamination of skin thus making it a unique initiative.

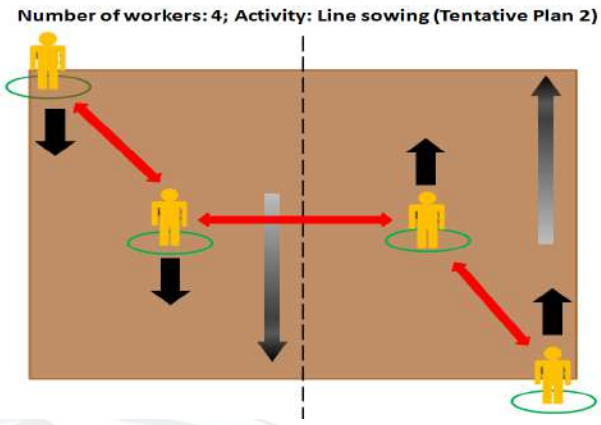
University of Petroleum Energy Studies, Dehradun has proposed innovative idea for sterilization of public spaces using ozone Micro-Nano-Bubbles (MNBs). Ozone makes a potent disinfectant with its strong oxidation ability and absence of harmful residue after treatment. These make it an ideal disinfecting agent. This technique has been found effective against bacterial contaminations. The University is working towards the possibility of designing a model that could be customized to household level and for public spaces such as hospitals, transport system etc.

2.2. Livelihood restoring activities

Social distancing followed by intensive public-health detection could chase down and eradicate the virus. Physical distancing and avoiding close contact is therefore an essential norm to tackle the emergency arising due to COVID-19. As agriculture is a labour intensive process and requires involvement of farm workers for activities such as sowing, weeding, fertilizer application and harvesting, a distancing-compatible farm work plan and movement strategy for farm workers to minimize contact was developed by IIMR, Ludhiana. In order to quickly adopt an optimized movement work plan, the possibility of using 'guide marks' along with field to indicate movement direction is being worked out with emphasis on using least number of guide marks, so that farm compliance is realized in view



of supply chain disruptions during the present emergency. A design plan for a unit piece of land taking cognizance of number of farm workers and farm days required to complete a particular task need optimization. This plan could be modified for other crops as well. Spatio-temporal technique and mobile-based flashlight application will be evaluated for cultivation Quality Protein Maize (QPM) leading to enhancement in the income of farmers.



Movement strategies designed for farm workers for maintaining social distancing

During COVID-19 outbreak India has observed reverse migration with vast number of migrant workers set off for their native places. As there is lot of influx from cities to villages, livelihood opportunities need to be created at grassroots. CIGR, Mathura, working in 16 villages of Gharwal and Kumaon region of Uttarakhand, proposed to extend its goat farming activities to 4 more villages through training and demonstration on scientific goat rearing practices as it could lead to livelihood opportunities for these migrants with minimal investment. CIGR would organize health camps for regular check-up, vaccination, distribution of goat feed, health kit, mineral mixture, molasses brick and lime for effective goat rearing. More than 250 farmers would be introduced to new retorting technique developed by the institute for enhancing the shelf life of meat and its value-added products thus creating diversified source of income and sustainable livelihood opportunities at village level through forward and backward linkages.

University of Agricultural Sciences, Bengaluru was primarily working towards development of pongamia pod decorticator and mini vegetable seed oil extraction machine. However, as a

Demonstration of oil extraction to farmers during training

part of SSR, more than 1500 farmers were apprised about the importance of vegetable oils as biofuels and cultivating non-edible oil trees, i.e., pongamia and neem etc. in association with Biofuel Park, Madenur; Mahatma Gandhi Institute of Rural Energy and Development, Bengaluru and Pavithra Rural Development Society, Bengaluru. An intensive hands-on training was given to 79 participants on liquid soaps production from pongamia and neem. As the demand of liquid hand soap has increased by manifold due to COVID-19 outbreak, these farmers would be further strengthend to create enterprise in liquid soap production by providing them forward and backward linkages.

National Institute of Technology (NIT) Puducherry has developed an IoT-based low-cost water quality monitoring and reporting system for aquaculture that optimizes the use of resources, improve sustainability and profitability. This low cost, energy efficient modules of sensor network can communicate on ZigBee standard it monitors and report important water quality parameters to aqua culturists and fish farmers in real-time through internet/mobile. Fish farmers of Karaikal district of Puducherry would be given training on the developed system along with the safety precautions to be taken in aquaculture field on various aspects such as feeding, harvesting etc. during COVID-19 pandemic period. The adoption of the new system is expected to enhance the income of established farmers and would create livelihood opportunities for new age aspirant farmers.

It is a moment of pride for India as its scientific community has emerged not only as knowledge generators and innovators but also as social workers and warriors. They are still working boundlessly day and night to fight against this deadly virus.

Acknowledgements: SEED Division, DST would like to acknowledge contribution and efforts of its S&T Organizations working in research laboratories and field to address local challenges with need-based S&T interventions. SEED Division would also like to thank Dr Sharad Shrivastava, CSIR-NBRI, for sharing the protocol of herbal hand sanitizer with stakeholders.

Resilience & Capacity building of women at grassroots through Women Technology Parks (WTPs)

Across every sphere, from health to the economy, security to social protection, the impacts of COVID-19 are exacerbated and women are no exception. The impacts of COVID-19 are already being felt harder by women in many areas of life due to gender inequalities, pre-existing health challenges or difficulties in accessing care, compromised dietary practices, poor affordability, low educational levels and lack of awareness. Women migrant workers and those working in rural enterprises and informal economy risk losing their livelihoods in the current crisis, with insecure contracts, no paid leave or the opportunity to work from home.

The Science for Equity Empowerment and Development (SEED) Division of the DST has been implementing "S&T for Women" scheme directed towards improving the socio-economic status of women, especially in rural areas, through capacity building and adoption of location-specific technologies, thereby reducing drudgery and improving the health conditions. Grant-in-aid support is being provided to several S&T-enabled Voluntary Organizations (NGOs) and Knowledge Institutions (KIs) under Women Technology Parks (WTPs) which act as single window hubs for convergence of diversified technologies, integrated with forward and backward linkages and creation of social enterprises for the holistic development of Women. These interventions increased the adaptive capacity and resilience of women to emerging

problems of livelihood systems and brought into practice innovative approaches towards creating opportunities for sustainable development through application of Science and Technology (S&T) inputs.

The NGOs and KIs have responded aptly in time and taken utmost care of women in their area of operation. Several NGOs and KIs as advised by SEED Division have tweaked the objectives of the projects to create resilience and improve the livelihoods of the women. The NGOs and KIs played a significant role in creating awareness, supply of relief materials and containment of the spread of COVID-19 besides ensuring Scientific Capacity Building. The network of organizations supported by SEED Division has demonstrated capabilities in manufacturing of masks as per the guidelines issued by Office of the PSA, Government of India and hand sanitizers as per WHO guidelines. Trainings were imparted to women for making masks and sanitizers. Hand wash with local herbal/medicinal plants and use of hand sanitizers enriched with local herbs to increase their safety and acceptability are being manufactured at village level. The masks and sanitizers were also distributed to frontline health workers like doctors, nurses, police etc. The demand for masks, hand wash and sanitizers had provided alternate source of livelihoods for women SHGs. Thus various stakeholders, KIs, State S&T Councils and NGOs who are engaged in Science & Technology-related programmes for women are being supported by the DST for making future plans for socio-economic empowerment of women through training, capacity building and skill development using locally available raw materials.

Immediate Interventions:

1. Women Technology Park at the North East Institute of Science & Technology (NEIST), Jorhat

Liquid Disinfectant & Hand Sanitizer

Rural Women Technology Park (RWTP) at NEIST had engaged rural women to prepare various products such as hand sanitizer, homemade mask, and liquid disinfectant to be distributed freely among family members and poor people in the nearby villages to help combat COVID-19 in the area. Rural women from the region were trained to produce homemade mask from traditional 'Gamocha' (a traditional Assamese cotton towel) by RWTP, Jorhat. More than 1000 masks were prepared and women were paid at the rate Rs. 15 per mask. Apart from this, 200 litres of liquid disinfectant is being produced. The women prepared about 50 litres of hand sanitizer and 160 litres of liquid disinfectant which have been distributed among the 60 women participants and their family members. The RWTP also prepared posters and leaflets on 'COVID-19: Do's and Don'ts' in Assamese for making people aware about the Coronavirus and precautionary measures to be being taken during the present situation.

2. RWTP at Krishi Vigyan Kendra (KVK), Sitapur

The RWTP at KVK Sitapur since the onset of the pandemic has been continuously creating awareness among rural community, especially women about the methods to protect from COVID-19 infections. Farm women were trained on "How to make hand sanitizer at home" using locally available materials like neem leaves, alum, camphor, aloe vera, tulsi leaves etc. and

Training of farmwomen/girls on "face mask making" through video message by Dr Saurabh, PI of RWTP, Sitapur

more than 60 litres of sanitizer was distributed among rural families of adjacent villages. Important information on social distancing, use of face masks and cleaning of hands was disseminated through hand written posters and announcements on mike. Awareness about the COVID-19 was created among the rural people and women through sensitization drives conducted at local ration shops, banks, sugar mills, community centres etc.

Online awareness sessions with the help of trainees of RWTP were conducted through ICT measures in 16 villages for sensitizing rural families on social distancing during household/ farm works, proper food and nutrition, nutritional garden, cleanliness and washing of hands. RWTP trainees further spread knowledge at ground level in their respective villages also. Video messages through mobile network were circulated on preparation of face mask using old clothes by hand. KVK through RWTP provided fabric, elastic band and thread to trained farmwomen for making of face masks. The masks were purchased by KVK thus providing income to the farmwomen. More than 600 face masks were distributed to villages, policemen and other government officials. RWTP further distributed migrant women with low-cost sanitary napkins to maintain hygiene during menstruation.

3. RWTP at Basani, Varanasi

RWTP at Basani, Varanasi is engaged in making facemask by training women as per WHO guidelines. The masks are being stitched by women trained at RWTP Centre. More than 500 masks have been distributed to the neighbourhood tribal families of Koiripur, Anei, Kuwar, Chanauli, Barhi Nevada of Baragaon development block, Varanasi. The RWTP gave online

Glimpses of activities of RWTP at Basani, Varanasi

training to create the digital designs and generate finished products. This online training is helping the women beneficiaries to utilize their time at home during the lockdown period. The staff is also sending online advisories of AYUSH to boost the immunity of the women at home. Besides these activities, woman at the RWTP prepared hand sanitizers which were given to the migrant workers, ration & food supply distributors, and villagers to be protected from the pandemic.

4. WTP at the JECRC University, Jaipur, Rajasthan

This WTP and other faculty members have created awareness about the Ayurvedic Kada -- The composition of Kada is giloy leaf, papaya leaf, pepper, clove, amla, and wheat leaf juvenile. More than 100 packets of ayurvedic kada and 1000 masks were distributed in Vidhani Village.

5. Sri Padmavati Mahila Vishwa Vidyalyam (SPMVV) and RWTP

With the on-going COVID-19 Pandemic, many programmes were organized by different Departments of SPMVV and its RWTP. The faculty, social work department and beneficiaries developed e-content and spread awareness about social distancing, hygiene and wearing masks etc. in nearby villages. Social work department along with the RWTP, SPMVV distributed daily necessities of vegetables including onion, tomatoes, cabbage, lemon, garlic etc. in the adopted village of Chitanyapuram, Karakambadi panchayat of Renigunta mandal. The teaching association of SPMVV donated fund and distributed food packets at multiple occasions to daily wagers of SPMVV, community, migrant workers etc.

6. Sona College of Technology, Salem along with its RWTP

This WTP has contributed during the COVID-19 pandemic by stitching masks and PPE kits through special sewing machines which are suitable for differently abled women who are compromised on their lower limbs. Besides these, normal women were also involved in masks and PPE stitching. These women sewed around 250 masks per day by using cotton fabric, nonwoven fabric and other suitable materials. So far more than 20,000 masks were stitched and distributed among workers dealing with COVID-19. The available sewing machines at the WTP were used for making PPE Nonwoven Coverall. Nearly 300 such coveralls were manufactured per day. Thus women were able to get livelihood and societal benefits.

Women at RWTP stitching masks on special sewing machines

7. RWTP, Malabar Social Service Society (MASSS), Kannur

This WTP joined the state run, "Break the Chain" campaign by sharing news links and updates through social media, awareness generation through posters and stickers, telephone etc. They have created a demonstration video on 'How to make sanitizer at home' in vernacular language,

because sanitizers were not available in local market and are not affordable for the poor families. Also a COVID-19 awareness video was made and shared for deaf and dumb community. The society also worked with the District Disaster Management Committee and distributed rations, sanitizers, masks, etc. to the needy. People were sensitized in making their own masks; useful information was also shared through WhatsApp groups and other social media.

Glimpses of Activities of RWTP at MASSS, Kannur

8. RWTP at PSGR Krishnammal College, Annur

The RWTP and the college adopted many villages within Annur area to sensitize people about COVID-19. Seventy-five faculty cum students formed number of groups to provide psychological counselling to people to deal with the uncertain times. These groups made audio-visual programmes, video films on dealing with pandemic, psychological handling of COVID-19 etc. Short documentary on adopting new healthy life style in regional language (Tamil) about "A healthy life style to fight against COVID-19" was created jointly with the students counselling cell of PSGRKCW. The Cell also created YouTube links with films on Stress counselling, Brain Dance – Mind Relaxation, Physical and Psychological Immunity, etc. Online lecture demonstration and training sessions were organised on topics like,"Importance about the Social Distancing, Isolation, Quarantine, purpose of hand-wash, use of sanitizers and masks, safe disposal of used mask, Ayurvedic immunity boosting measures by AYUSH, liquid soap & sanitizer making, etc. More than 500 persons were trained through these online sessions. Nearly 500 masks were prepared and distributed among villagers as a result of online training of volunteers.

9. The Punjab State Council for Science & Technology (PSCST), Chandigarh

PSCST encouraged a group of women in village Gugwaal Haar situated in Hajipur Block of District Hoshiarpur, Punjab to prepare 'Homemade mask'. The masks were prepared by a group of five young inspiring women led by the Village Sarpanch. These women worked tirelessly and distributed masks amongst nearby village residents, vulnerable migrant workers and ration/ food supply distributors. These masks were made as per the standards of O/o PSA. More than 2000 masks were distributed in four villages in that area. Further, PSCST has also created a WhatsApp Group including Sarpanches, local SHGs, women and farmers from various villages (about 30) of Talwara Block. The members of WhatsApp group are being sensitized about the various advisories being issued by State/Central Government.

Interventions for Economic Resilience during Post-COVID Period

As part of long-term measure for enhancing the livelihood opportunities for marginalised and dislocated women – migrants, casual labours, wives of casual labourers not having any

livelihood opportunity due to mass closure of industrial set ups in major cities – proposals can be invited for training and capacity building of such women from the State S&T Councils, S&T-based agencies, KIs, etc. Some of the interventions being planned for economic resilience are given in the following section.

1. RWTP at KVK Sitapur

Training will be imparted to migrant women in skill development as even after corona pandemic most of them will not go back to the cities. The skills which have been selected are Nursery pot making from cow dung;

- Agarbatti/Dhoopbatti making from cow dung;
- Diya/Name Plate making from cow dung powder;
- Charcoal Briquettes fuel making from Agro-waste/By-products.

2. Pushpa Gujral Science City (PGSC), Kapurthala

PGSC has started training programmes with local women in mask making as per the standards provided by the PSA office, through tweaking of the existing project on "Empowerment of women in rural areas through science-based skill Development". The women are being trained in nearby villages in mask making. Nearly 5000 masks will be prepared and distributed to empower local women in income generation.

3. WTP at the NEIST, Jorhat

Under this WTP there is already a component of making disinfectants of good quality for economic empowerment of rural women. They will upscale the production of disinfectants for supply in the community and healthcare institutions. Besides this masks of standard quality will also be made in the WTP.

4. The State Council for Science Technology & Environment (SCSTE), Meghalaya

SCSTE, Meghalaya based on its technologies during the lockdown period has come up with S&T interventions/solutions for this challenging time of COVID-19 pandemic. The initiative to be taken will focus on the gaps in livelihood, socio-economic and health issues. The council has a Women Technology Park cum resource centre at the Bolomoram TRC cum Knowledge Innovation Park, East Garo Hills, Meghalaya wherein migrant population and women beneficiaries will be trained in new emerging sustainable green technologies, construction-related technologies, etc. To address the issue of health and nutrition they will be encouraged to grow nutritional gardens, seed banks etc. In the Bolmoram cluster seven villages which are away from headquarters were supported by transportation of essential food supplies during the lockdown period. The locals were also helped in sale of their goods by enabling its transportation. Also, in order to encourage women and adolescence girls in hygiene and safety care, women groups will be trained in the making of sanitary pads. Machine for making those item has been given by NIF wherein the same will also be supplied to other remote villages which will create jobs and earning activities for these women villages. The above activities will be carried out in a convergence made with village Dorbars, State Rural Livelihood Mission (SRLM), volunteers and other nongovernmental organizations. There can be training programmes in Stabilized mud block, treated bamboo, rain water harvesting, Low

cost sanitation/ toilet, etc. Local labourers will be trained on the above technologies based on their skills and interests.

5. RWTP at PSGR Krishnammal College, Annur

The RWTP is involved in many income-generating activities for women empowerment like water purification, community nursery, post-harvest technology, value-added products, Multi millet biscuits, Banana fibre extraction and value-added products, Coir pot, Areca nut plates, Bio briquettes and Sanitary-napkin production etc. For future the college is proposing Knowledge Sharing, Skill Development and Scientific & Technical Capacity Building of Communities by:

(a) Training jobless women in the locality with the basket of technologies using digital modes, in which they will be trained in usage of apps. #MeraMobileMeraMarketing program, which is a disruptive bottom up approach for enabling Digital Marketing through their own mobiles to be conducted for marketing support of rural women. Further, the group will be educated to utilise the indigenous Web portal www.marketmirchi.com highlighting all rural/agro categories for free digital marketing of rural products/agro products, agro inputs, agro services and agro jobs.

(b) Production of value-added products from locally available resources like millets, cereals, sugar cane, banana, coconut and other locally available produce. These can be supplied to the needy people through local authorities like District Administration, Panchayat Raj Institutions etc.

(c) Training programmes on Solar dehydration of vegetables, greens and fruits, value addition to Tomato, rice and millet, Millet Products (Bread, Biscuits and others), Banana Fibre, Areca nut plates, Bio-Briquette, Immunity diet, value Added Food products, Community Nursery and skill development in banana fibre making.

(d) Awareness programme to educate pregnant and lactating women about the low cost but nutritive diet plans, hygiene and safety to be conducted.

8. Media Coverage of DST initiatives on COVID-19

I. DST Communication Cell

During COVID time, the DST Media Cell was assigned the task of highlighting the initiatives taken by DST and its Autonomous Institutions to combat the COVID-19 pandemic through the various platforms of the media (Print, Digital & Electronic).

This involved a focused communication to make people aware of the Science and Technology initiatives taken by the DST related to the pandemic as part of the mandate of DST Media cell. The Cell has been working on communicating S&T and projecting the achievements of DST through digital platforms. It is also producing scientific content of DST and its associated scientific institutions and communicating on the digital and social media for wider dissemination and outreach since 2016.

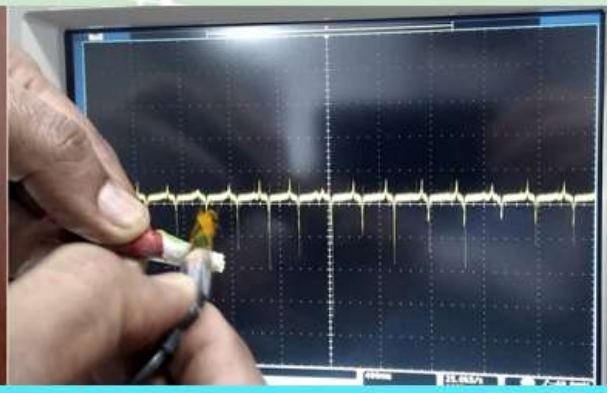
Some major achievements related to the creation and dissemination of content related to the COVID-19 pandemic are the following:

1. Digital Media: The DST media cell has done more than 100 stories on COVID-19-related research development and innovation. The stories have been disseminated through print, digital and social media. The digital media impact of these stories has been notable, with around 50 stories appearing per month on COVID-19.

2. These stories have been released all over India by the Press Information Bureau in English and many of them in Hindi from their national as well as regional bureaus.
3. Social Media: Content on different aspects of COVID-19 have been regularly posted on Facebook and Twitter accounts of DST and has reached its more than 1 lakh follower and beyond. It has attracted several like, followers and created significant footprints of DST COVID-19 related achievements on social media.
4. Print media: Several national newspapers like Hindustan Times, Indian Express, The Hindu, Times of India, as well as regional and vernacular paper have carried DST achievement stories on COVID-19 research, development, and innovation.
5. A monthly e-newsletter – STRIDES is being published every month since September 2019 by DST Media Cell. The Cell has published a special issue on COVID-19 in April 2020. After that, each issue has carried one section on research and development, innovation, and implementation of technologies for COVID-19.
6. More than 100 creative, including infographics, banner, slideshows, and posters related to COVID-19 research, development, innovation, and other activities have been developed and used on DST social media and website.
7. Infographics have been prepared for the Office of the Union Minister for Science and Technology, Earth Sciences, Health, and Family Welfare along with stories and social media content, and many of such content have been used from the Union Minister's social media handles.
8. Content has been provided for the electronic media and it has found a place in some of the national and private electronic media outlets like Doordarshan, Lok Sabha TV, Rajya Sabha TV, etc.

CeNS develops Tribo E mask to protect healthy individuals from COVID 19

- The mask is three-layered – a layer of nylon cloth sandwiched between polypropylene layers, the latter sourced from commonly used non woven grocery bags
- The layers are rubbed against each other, static electricity is produced, which is expected to restrict the possible transmission of infections
- The mask is inexpensive and doable by anyone



IndiaDST www.dst.gov.in @IndiaDST

Integrated geospatial platform to help area-specific strategies & decisions in COVID-19 outbreak

- Integrated Geospatial Platform created out of available geospatial datasets, standards-based services, and analytic tools to help decision making during the current COVID-19 outbreak and aid devising area-specific strategies to handle the socio-economic impact in the recovery phase
- The platform is expected to strengthen the public health delivery system of the State and Central Governments and also provide geospatial information support to citizens and agencies dealing with the challenges related to health, socio-economic distress, and livelihood
- The mobile application SAHYOG, as well as a webportal prepared & managed by SoI, has been customized to collect COVID-19 specific geospatial datasets through community engagement to augment the response activities by Government of India to the pandemic

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Rural Women from Assam prepare products like hand sanitizer, homemade mask to combat COVID19

- RWTP under CSIR-North East Institute of Science and Technology, Jorhat, Supported by SEED Division, DST, have engaged rural women to prepare various products such as hand sanitizer, homemade mask, and liquid disinfectant to be distributed freely among family members and poor people in the nearby villages to help combat COVID 19
- Rural women from the region were trained to produce homemade mask from traditional *Gamocha*, a traditional Assamese cotton towel
- It has been proposed that the women be paid at the rate of Rs.15/- per mask

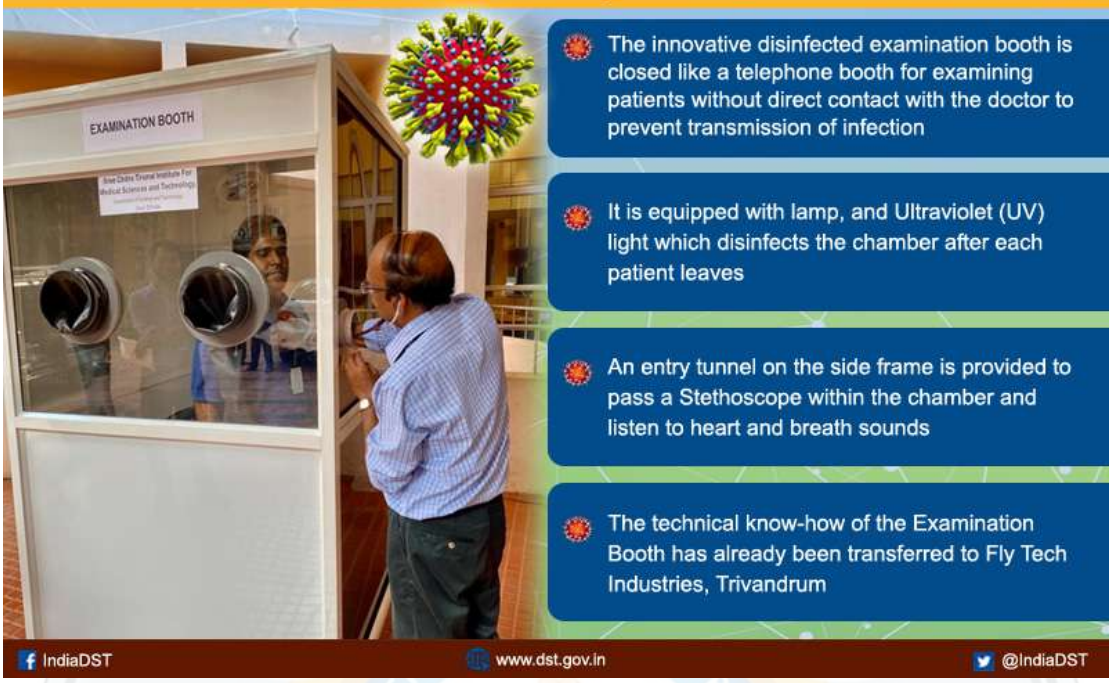
IndiaDST www.dst.gov.in @IndiaDST

SCTIMST Scientists develop Disinfection Gateway & Facemask Disposal Bin to fight COVID-19

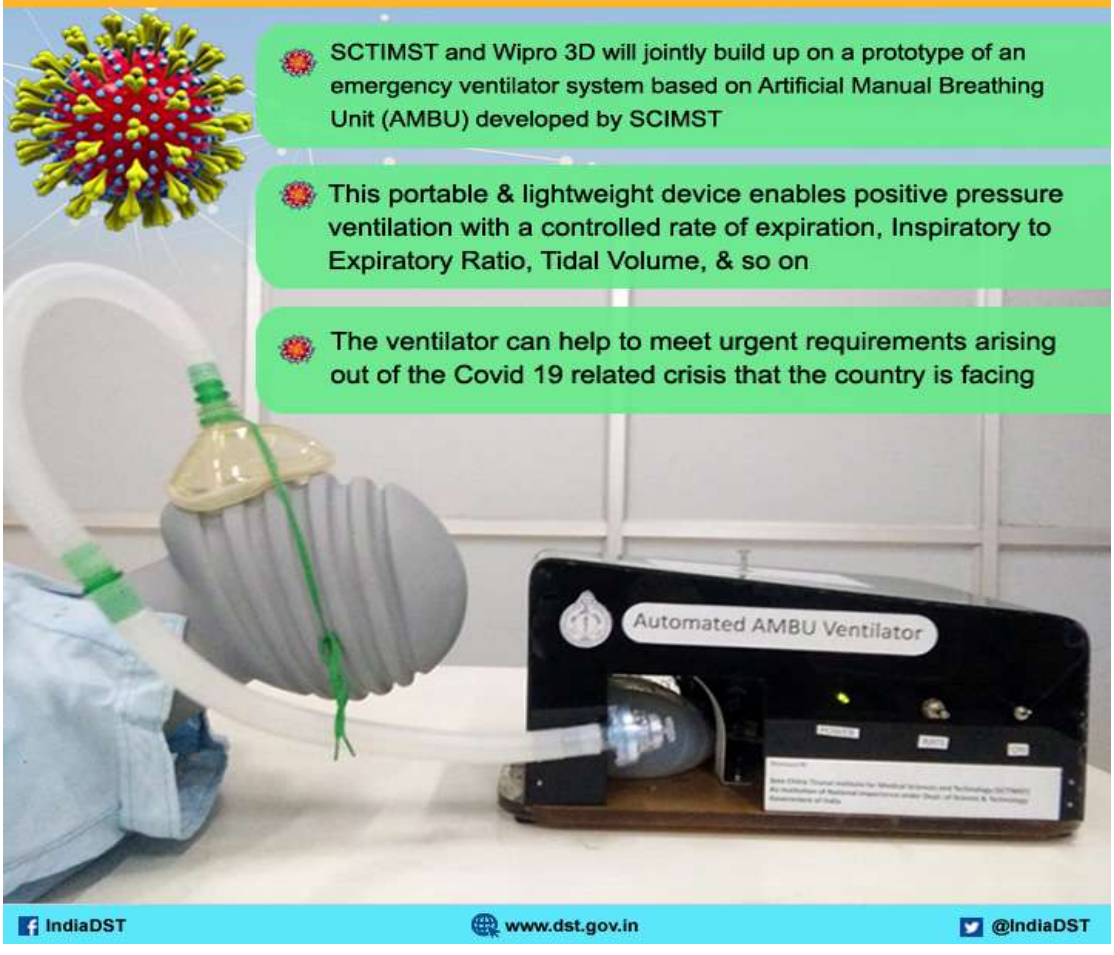
- Chitra Disinfection Gateway a portable system equipped with a technology for generating hydrogen peroxide mist and UV based decontamination facility which will decontaminate body, hands and clothes of a person and also the chamber.
- Chitra UV Based Facemask Disposal Bin can be used by Health workers in hospitals and in public places where decontamination of used facemask, overhead covers, face shields and so on are required to break the infection chain.

IndiaDST www.dst.gov.in @IndiaDST

SCTIMST Scientists develop disinfected barrier-examination booth for COVID-19 patients

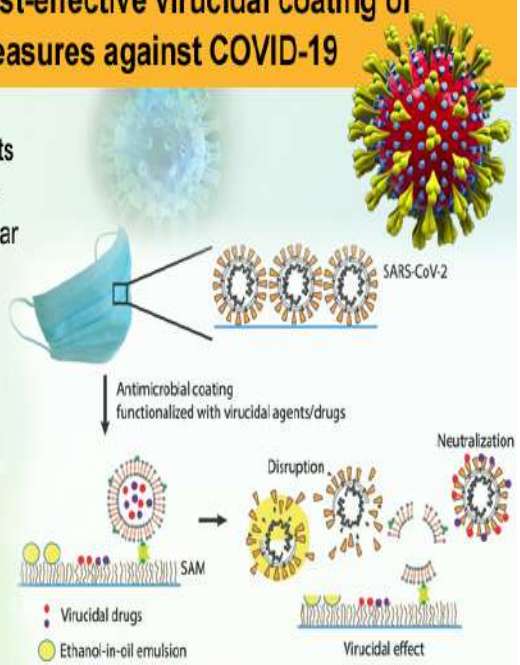


SCTIMST ties up with Wipro 3D to manufacture automated ventilators to meet COVID 19 related crisis



IIT Kanpur Researchers to design a cost-effective virucidal coating of surgical masks for preventive measures against COVID-19

- SERB-DST is supporting research by a team of scientists from IIT Kanpur for developing a protective coating that would help in making medicated masks and medical wear (PPE) for fighting COVID-19.
- The coating would include a combination of common polymers containing anti-microbial properties and re-purposable anti-viral molecules and materials used would make it a cost effective solution.
- Doctors and nurses, treating COVID-19 patients will benefit from this as it would add a layer of security for them while treating COVID-19 patients.



IndiaDST www.dst.gov.in @IndiaDST

DST funded startup develops chemical free silver based disinfectant to fight COVID 19 pandemic

- Weinnovate Biosolutions, a DST & BIRAC funded startup brings non-alcoholic aqueous-based Colloidal Silver solution for disinfecting hands and environmental surfaces
- This noninflammable liquid free of hazardous chemicals can be an effective sanitizer & can prevent the spread of the infection through contact
- It can prevent further infection protecting health professionals and other infected people
- Solution underwent lab testing, test licence received and synthesis of colloidal silver in a small scale and scale-up batch upto 5 litres conducted with reproducibility

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II. E-Newsletter on S&T Efforts in India on COVID-19

During lockdown, SCTIMST geared up to meet COVID-19 pandemic with R&D, technologies and products

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) is an institution of national importance under the DST. It stood out with its research, technologies, and innovations to meet the need of the hour in India's fight against COVID-19.

Even though the Institute had to quarantine a number of staff when a foreign-returned doctor was detected with COVID-19 much before the nationwide lockdown, SCTIMST rose up to the occasion to bring out several technologies and products that could be crucial to combat the diseases. Its one-step confirmatory diagnostic kit for COVID-19 developed in three weeks could solve India's urgent need for rapid testing. The other R&D work on the issue included a UV-Based Facemask Disposal Bin which can be used by health workers in hospitals and in public places for decontamination of used facemask, overhead covers and face shields, a superabsorbent material for liquid respiratory and other body fluid solidification and disinfection for the safe management of infected respiratory secretions and a disinfected barrier-examination booth for examining COVID-19 patients.

Contact info: Ms Swapna Vamadevan, PRO, SCTIMST; pro@sctimst.ac.in

Website link:
https://dst.gov.in/amid-lockdown-sctimst-gears-meet-covid-19-pandemic-rd-technologies-and-products

DST supports development of reusable N95 & N99 mask with enhanced antiviral efficiency

The DST has approved support for development and upscaling of reusable N95 and N99 masks with enhanced antiviral and antibacterial property designed by Dr Sri Sivakumar from Indian Institute of Technology, Kanpur under the Nano Mission. The masks will be made of nanofibers developed from polymers (e.g., chitosan, polycaprolactone, polyethylene terephthalate, polypropylene). They will have inorganic antiviral or bacterial nanoparticles as well as organic antiviral and bacterial molecules. The nanofiber-based masks will have four layers of construction, and filtration size would be 0.01 to 0.3 micrometres.
N95 and N99 are classified as an antipollution face mask, which possesses 95% and 99% filtration efficiency of 0.3-micron particulate matter, respectively. However, these masks fail to protect a person from the particle size lesser than 0.3 microns. To achieve higher filtration efficiency between the range of 0.01-0.3 micron particulate matter (e.g., Coronavirus, bacteria, and other pollutants), the mask has to be designed with finer pore size.

Contact info: Dr Sri Sivakumar, Email: srisiva@iitk.ac.in

Website link:
https://dst.gov.in/dst-supports-development-reusable-n95-n99-mask-enhanced-antiviral-efficiency

SNBNCBS develops Nanomedicine to alter oxidative stress for better immune power to treat viral infections including COVID-19

Scientists at S. N. Bose National Centre for Basic Sciences, Kolkata (SNBNCBS) have developed a safe and cost-effective nanomedicine that promises treatment of a number of diseases by altering oxidative stress in the body. The research may provide a ray of hope in India's fight against COVID-19, as the nanomedicine can decrease or increase reactive oxygen species (ROS) in our body, depending on the situation and cure the disease.

The ability of this research for controlled enhancement of ROS in mammals raises hopes of a new potential for the application of nanomedicine in controlling virus infections, including COVID-19. Animal trial for the Reduction & Oxidation processes (Redox) healing of several diseases is completed, and now the institute is looking for sponsors to start clinical trials on humans.

Contact info: Dr Samir K Pal, Senior Professor, skpal@bose.res.in

Website link:
https://dst.gov.in/snbncbs-develops-nanomedicine-alter-oxidative-stress-better-immune-power-treat-viral-infections

SERB approves funding for study of mathematical & simulation aspects of COVID-19

Science and Engineering Research Board (SERB), a statutory body under the DST, has approved funding for 11 projects under MATRICS scheme for studying Mathematical modelling and computational aspects to tackle the COVID-19 pandemic.

Most of these studies attempt to propose mathematical/simulation models to account for various factors relevant to COVID-19 by modifying the basic SIR (Susceptible-Infected-Recovered) models. Some of such factors are heterogeneity of population, the role of asymptomatic population, migration and quarantine, effect of social distancing and lockdown, socioeconomic factors and so on. These studies will be primarily aimed to study Indian conditions and will provide an estimate of Basic Reproduction Number-- the qualitative indicator of the degree of contagiousness of the disease. These will be helpful to forecast future pandemic by using the data available and provide fundamental insights into kinetics and management of infectious diseases.

Contact info: Dr Premila Mohan, Scientist 'G', SERB, premilamohan@serb.gov.in

Website link:
https://dst.gov.in/serb-approves-funding-study-mathematical-simulation-aspects-covid-19

DST launches programme on health & risk communication with focus on COVID-19

National Council for Science & Technology Communication (NCSTC) has launched a programme on health and risk communication 'Year of Awareness on Science & Health (YASH)' with focus on COVID-19. It is a comprehensive and effective science and health communication effort for promoting grassroot-level appreciation and response on health and would help saving and shaping the lives of people at large, as well as build confidence, inculcate scientific temper and promote health consciousness among them.

The current pandemic scenario has posed concerns and challenges all around, where scientific awareness and health preparedness play a significant role to combat the situation. This requires translation and usage of authentic scientific information to convey the risks involved and facilitates communities to overcome the situation. The programme will encompass development of science, health, and risk communication software, publications, audio-visual, digital platforms, folk performances, trained communicators, especially in regional languages, to cater to various cross-sections of the society in the country.

Contact info: Dr Manoj Kumar Patairiya, Adviser & Head, NCSTC, mkp@nic.in

Website link:
https://dst.gov.in/dst-launches-programme-health-risk-communication-focus-covid-19

Sree Chitra develops 2 types of swabs and viral transport medium for COVID-19 testing

Technologists at the Sree Chitra Triunal Institute for Medical Sciences and Technology (SCTIMST), an autonomous institute under the DST, have developed two types of nasal and oral swabs and viral transport medium for COVID-19 testing.

Chitra EmBed flocked nylon swabs (co-developed with Mallelil Industries Pvt ltd) and Chitra EnMesh, polymeric foam-tipped, lint-free swabs with flexible plastic handles developed by technologists Dr Lynda V Thomas, Dr Shyni Velayudhan and Dr Maya Nandakumar from SCTIMST have both proven efficiency in the adequacy of specimen collection and rapid elution (extracting one material from another by washing with a solvent) of specimen into the liquid viral medium. They also have good recovery of viral RNA collected using these swabs and medium. The swabs will be available as sterile, ready-to-use devices.

Contact info: *Ms Swapna Vamadevan, PRO, SCTIMST, Email: pro@sctimst.ac.in*

Website link:
https://dst.gov.in/sree-chitra-develops-2-types-swabs-and-viral-transport-medium-covid-19-testing

BSIP joins hands with Govt. of UP to combat COVID-19 in the state

The Government of India, along with the State Governments, has been relentlessly working for prevention, containment, and management of COVID-19. Birbal Sahni Institute of Palaeosciences (BSIP), an autonomous institute under the DST, joined hands with the Government of Uttar Pradesh to combat COVID-19 in the state. BSIP, as one of the five Central Government Research Institutes in Lucknow, took initial steps to start laboratory testing of COVID-19. The availability of the ancient DNA BSL-2A laboratory in the Institute itself made it possible to prepare for testing immediately.

BSIP received the first batch of suspected COVID-19 samples to test on 2nd May 2020, from district Chandauli. Since then, the lab is running 24x7 to test approximately 400 samples per day from various districts of Uttar Pradesh, as decided by the nodal authorities.

Website link:
https://dst.gov.in/bsip-joins-hands-govt-combat-covid-19-state

NATMO publishes 4th updated version of its COVID-19 Dashboard

National Atlas and Thematic Mapping Organization (NATMO) functioning as a subordinate department under the Department of Science & Technology, Ministry of Science & Technology, Government of India published the 4th updated version of COVID-19 Dashboard on its official Portal at http://geoportal.natmo.gov.in/Covid19/ on 19th June 2020.

Website link:
https://dst.gov.in/sites/default/files/Report%20on%204th%20Update%20of%20COVID19%20Dashboard%20NATMO.pdf

Chitra Gene LAMP-N makes confirmatory tests results of COVID-19 possible in 2 hours

Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, an institute of national importance of the DST, has developed a diagnostic test kit that can confirm COVID-19 in 2 hours at low cost.

The confirmatory diagnostic test, which detects the N Gene of SARS-CoV-2 using reverse transcriptase loop-mediated amplification of viral nucleic acid (RT-LAMP), will be one of the world's first few if not the first of its kinds in the world.

The test kit, funded by the DST called Chitra GeneLAMP-N, is highly specific for SARS-CoV-2 N-gene and can detect two regions of the gene, which will ensure that the test does not fail even if one region of the viral gene undergoes mutation during its current spread.

Website link:
https://dst.gov.in/chitra-genelamp-n-makes-confirmatory-tests-results-covid-19-possible-2-hours

A predictive model by JNCASR with potential help prepare for medical needs for COVID-19

A team of researchers from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) an autonomous institute under the DST along with collaborator from IISc Bengaluru have developed a heuristic predictive model for COVID-19 that provides short-term predictions about the evolution of the disease and the medical needs that are generated as a consequence.

The model focuses on the 'Achilles' heel' of COVID-19 response – medical inventory management. By providing key figures for medical inventories such as PPEs and ventilators, this model can greatly aid a systematic and meticulously planned response to the pandemic. It will provide a full layout of the medical inventory needs, including intensive care, acute care, and medical supplies requirements, district-wise, for the coming weeks. It will also provide a pan-India overview of the development of the pandemic, but also a state and district-level insight into its progress.

Website link:
https://dst.gov.in/predictive-model-jncasr-can-help-prepare-medical-needs-covid-19

SCTIMST to organize commercial launch of Agappe Chitra Magna for detection of COVID-19

The commercial launch of,Agappe Chitra Magna, a magnetic nanoparticle-based RNA extraction kit for use during testing for detection of COVID-19 developed by Sree Chitra Tirunal Institute

for Medical Sciences and Technology (SCTIMST) along with Agappe Diagnostics Ltd, an in vitro diagnostics manufacturing company based in Cochin was being organized on May 21, 2020, at 4.30 PM.

The launch programme was organized by SCTIMST in collaboration with Agappe Diagnostics Ltd at the Biomedical Technology Wing of SCTIMST.

Dr VK Saraswat, NITI Aayog member and President of Institute Body of SCTIMST, and Prof. Ashutosh Sharma, Secretary, DST, participated in the commercial launch of Agappe Chitra Magna, through video conferencing.

Website link:
https://dst.gov.in/sctimst-organize-commercial-launch-agappe-chitra-magna-detection-covid-19

SCTIMST scientists develop disinfection gateway & facemask disposal bin to fight COVID-19

Scientists at Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram have designed two technologies to fight COVID-19 pandemic.

Chitra Disinfection Gateway is one of the two technology designed by SCTIMST scientists Jithin Krishan and Subash VV from the Division of Medical Instrumentation for the decontamination of people, one at a time. It is a portable system equipped with a system for generating Hydrogen peroxide mist and UV-based decontamination facility.

Website link:
https://dst.gov.in/sctimst-scientists-develop-disinfection-gateway-facemask-disposal-bin-fight-covid-19

CeNS uses electrostatics of materials to develop Tribo E mask to protect healthy individuals from COVID 19

Face masks used by frontline healthcare professionals, which are of high technical quality, need special expertise for production; while a simple face mask that can contain the spread of the Coronavirus is advised for the general public.

Such a mask, though rudimentary in its action for containing the viral diffusion across the fabric layer, is expected to reduce the transmission of micro-droplets that linger in the air even during a simple conversation, let alone sneezing. Simple, often, homemade ones are advised for healthy individuals rather than those meant for health workers as there is limited supply of the latter. If only the choice of the fabric can be made intelligently, the mask can serve the purpose more efficiently.

Website link:
https://dst.gov.in/cens-uses-electrostatics-materials-develop-tribo-e-mask-protect-healthy-individuals-covid-19

UV disinfection trolley to effectively clean up hospital spaces to combat COVID-19

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous R&D Centre of the DST, and University of Hyderabad (UoH) together with the help of Mekins Industries Ltd. (MIL) have developed a UVC-based disinfection trolley to fight against COVID-19 by rapid cleaning of hospital environment.

UV light in the range of wavelengths between 200 and 300 nm is capable of inactivating microorganisms, such as bacteria and viruses, thus disinfecting both air and solid surfaces. Often, chemical disinfectants are not enough to remove the bacteria and viruses found in hospitals and other contamination prone environment. Rapid decontamination of the used patient-care beds and hospital rooms before admission of subsequent occupants is a major requirement in hospitals in view of the limited availability of beds. Coronavirus is sensitive to UVC light, as in the case of other viruses and bacteria. The germicidal effects of UVC irradiation with a peak intensity at 254 nm results in cellular damage of the virus, thereby inhibiting cellular replication. Unlike chemical approaches to disinfection, UV light provides rapid, effective inactivation of microorganisms through a physical process.

Website link:
https://dst.gov.in/uv-disinfection-trolley-can-effectively-clean-hospital-spaces-combat-covid-19

DST-supported healthcare start-up developing rapid test for detection of COVID-19

The DST has funded 'Module Innovations'', a Pune based healthcare start-up working on point-of-care diagnostics to build up on its platform technology for rapid diagnosis of diseases to develop a product for detecting COVID-19 with a 10 to 15-minute test.

Using the proven concept from its flagship product USense, the Module is now developing nCoVSENSEs™ which is a rapid test device for detection of antibodies that have been generated against the COVID-19 in the human body.

Website link:
https://dst.gov.in/dst-supported-healthcare-startup-developing-rapid-test-detection-covid-19

DST supported development of reusable N95 & N99 mask with enhanced antiviral efficiency

The DST has approved support for development and upscaling of reusable N95 and N99 masks with enhanced antiviral and antibacterial property designed by Dr Sri Sivakumar from Indian Institute of Technology, Kanpur under the Nano Mission.

The masks will be made of nanofibers developed from polymers (e.g., chitosan, polycaprolactone, polyethylene terephthalate, polypropylene). They will have inorganic antiviral or bacterial nanoparticles as well as organic antiviral and bacterial molecules. The nanofiber-based masks will have four layers of construction, and filtration size would be 0.01 to 0.3 micrometres.

Website link:
https://dst.gov.in/dst-supports-development-reusable-n95-n99-mask-enhanced-antiviral-efficiency

Study to identify biomarkers to predict progression from non-severe to severe COVID-19 cases can help interventions

The Science and Engineering Research Board (SERB), a statutory body under the DST, will support exploration of metabolomics alteration in COVID-19-infected patients conducted by IIT Bombay in collaboration with some hospitals in Mumbai.

The study will identify potential biomarker candidates to predict progression from non-severe to severe COVID-19 conditions. Search for potential diagnostic candidates will involve metabolite profiling of different patient groups with various complications. Metabolites are small biomolecules, capable of regulating various pathways in all the living-organisms.

Website link:
https://dst.gov.in/study-identify-biomarkers-predict-progression-non-severe-severe-covid-19-cases-can-help

ARCI & Mekins develop UVC-based multipurpose disinfection cabinet for containing surface contamination of COVID 19

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous R&D Centre of the DST, and MEKINS Industries have co-developed a UVC-based cabinet for disinfecting non-critical hospital items, laboratory wear, and PPEs in the research laboratories to prevent surface contamination of COVID-19.

It can also be used to disinfect items exhibited to customers in commercial establishments and several domestic items.

India was successful in controlling the spread of COVID-19 caused by the SARS-CoV-2 virus during the first few phases of the lockdown due to strict implementation of COVID-19 guidelines. But, with relaxation of the lockdown, there is a chance of slow spread of disease due to the movement of people across the country, and this is predicted to continue for some time. Transmission through surface contamination is an unpredictable risk in which common utilities play a key role.

Website link:
https://dst.gov.in/arci-mekins-develop-uvc-based-multipurpose-disinfection-cabinet-containing-surface-contamination

DST initiates COVID-19 India National Supermodel for monitoring infection transmission & aid decision-making by policymakers

The DST has initiated a COVID-19 Indian National Supermodel to help monitor the future transmission of infection, thus aiding decisions involving health system readiness and other mitigation measures.

While the Government is keeping a close watch on infectivity and mortality, it is imperative to bring in a robust forecasting model for predicting the spread and enhancing disease surveillance. Numerous mathematical models for COVID-19 forecasting and surveillance are being worked out by investigators funded by DST-SERB (Science and Engineering Research Board) and other agencies.

Inspired by India's history of using mathematical models for disaster management planning of metrological events, DST has initiated this exercise to pool in expertise in the field and create one model for the entire country that will be subjected to rigorous tests required for evidence-based forecasting, routinely practiced in weather forecasting communities.

Website link:
https://dst.gov.in/dst-initiates-covid-19-india-national-supermodel-monitoring-infection-transmission-aid-decision

DST set up rapid response centre at SINE, IIT Bombay to combat COVID-19

The DST, in a rapid response to combat COVID-19 global pandemic, approved setting up of a Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH) at a total cost of Rs. 56 Cr to scout, evaluate and support the innovations and start-ups that address COVID-19 challenges. The Society for Innovation and Entrepreneurship (SINE), a technology business incubator at IIT Bombay supported by the DST has been identified as the Implementing Agency of the CAWACH.

Given the impact of COVID-19 as a pandemic globally that has jolted countries across the world to take immediate actions and scale up responses to detect, treat and reduce transmission to save people's lives, DST is playing a critical role to pace up India's efforts to fight the crisis.

While the nation is under a health emergency, various solutions to address the pandemic are being undertaken at research institutions & laboratories. Urgent measures are being taken by Governments at both Centre and State level to shore up these efforts and infuse resources in various forms to contain the further havoc of COVID-19.

Website link:
https://dst.gov.in/dst-sets-rapid-response-centre-sine-iit-bombay-combat-covid-19

DST launches nationwide exercise to map & boost COVID-19 solutions with R&D, seed & scale up support

Rising to the National Call to combat the public health crisis arising out of COVID-19 pandemic, the DST is synergising and consolidating the various activities carried out by the Ministry of S&T and its network of autonomous institutions and scientific bodies across the country.

The solutions and novel applications to address COVID-19 pandemic-related challenges are being taken up through a three-pronged approach. These include (a) extensive mapping of solutions requiring R&D support, start-ups with viable products requiring facilitation and manufacturing support; (b) identification of market deployable products requiring seed support and (c) support for solutions already in market but requiring substantial scale up to augment their manufacturing infrastructure and capabilities.

The Science & Engineering Research Board (SERB), an autonomous institution of the DST, has already sent out a call to invite proposals as part of special call under IRHPA (Intensification of Research in High Priority Area) scheme specifically designed for COVID-19 and related respiratory viral infections to ramp up national R&D efforts for new anti-virals, vaccines, and affordable diagnostic. The call which invites submissions by March 31, 2020 has garnered encouraging response from scientists across India.

Website link:
https://dst.gov.in/dst-launches-nationwide-exercise-map-boost-covid19-solutions-rd-seed-scale-support

Dr Harsh Vardhan releases White paper on Focused Interventions for Make in India: Post-COVID-19 by TIFAC

Dr Harsh Vardhan, Union Minister for Science & Technology, Health and Family Welfare and Earth Sciences released a white paper on "Focused Interventions for 'Make in India': Post-COVID-19" and "Active Pharmaceutical Ingredients: Status, Issues, Technology Readiness and Challenges", prepared by Technology Information, Forecasting and Assessment Council (TIFAC), at Nirman Bhawan, New Delhi. Dr V K Saraswat, Chairman, TIFAC Governing Council, Prof. Pradeep Srivastava, Executive Director, TIFAC, Dr Sanjay Singh, Scientist 'G' and Shri Mukesh Mathur, In-charge (F&A), TIFAC were also present on the occasion.

Website link:
https://dst.gov.in/dr-harsh-vardhan-releases-white-paper-focused-interventions-make-india-post-covid-19-tifac

JNCASR spinoff launched molecular probes used in COVID-19 test kits

VNIR Biotechnologies Private Limited, a spinoff by Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute of the DST launched indigenous fluorescence probes and Polymerase chain reaction (PCR) mix for Reverse transcription polymerase chain reaction (RT-PCR) detection which are molecular probes used in COVID-19 test kits.VNIR Biotechnologies Private Limited is incubated at Bangalore Bio-innovation Centre (BBC) of Government of Karnataka.

"This initiative of developing products locally is in line with our Prime Minister's 'Aatmanirbhar Bharat' mission. We must take pride of the fact that we have reached this level of innovating and producing locally," said Dr C.N. Ashwath Narayan, Deputy Chief Minister of Karnataka, who attended the product launch on July 7, 2020, at Bangalore Bio-innovation Centre (BBC). The programme was also attended by Dr E.V. Ramana Reddy, Additional Chief Secretary IT/BT and Dr Jitendra Kumar, Managing Director of Bangalore Bioinnovation Center.

Website link:

https://dst.gov.in/jncasr-spinoff-launched-molecular-probes-used-covid-19-test-kits

ARCI & Vehant Technologies co-develop UV System for baggage Scan Disinfection to fight COVID-19

Both domestic and international travel has been a major reason for spread of the COVID-19 infection. Baggage, an inevitable part of travel, involves handling by multiple people and can be contact points for spread of the virus and should be disinfected quickly each time they change hands. With increase in the passenger traffic at airports, railway stations and commercial establishments during the post-lockdown period, there is an immediate necessity for a rapid system for the baggage disinfection within few seconds to effectively fight against COVID-19. In order to control spread of infection through baggage, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, an autonomous R&D Centre of the DST and Vehant Technologies, Noida have co-developed KritiScan® UV Baggage Disinfection System.

Website link:

https://dst.gov.in/arci-vehant-technologies-co-develop-uv-system-baggage-scan-disinfection-fight-covid-19

TIFAC releases report on Active Pharmaceutical Ingredients- Status, Issues, Technology Readiness and Challenges

Indigenous production of Active Pharmaceutical Ingredients (APIs) needs to be scaled up to a level where the production is economically viable, says a report which identified a list of APIs that need prioritized manufacturing and the associated advantages.

The report titled 'Active Pharmaceutical Ingredients- Status, Issues, Technology Readiness, and Challenges' was brought out by Technology Information Forecasting and Assessment Council (TIFAC), an autonomous organization under the DST.

It was released along with a white paper on 'Focused Interventions for 'Make in India': Post-COVID-19' by Dr Harsh Vardhan, Union Minister for Science & Technology, Health and Family Welfare and Earth Sciences at a virtual function on 10th July 2020. Dr V K Saraswat, Member

S&T Niti Aayog & Chairman TIFAC Governing Council, Prof. Pradeep Srivastava, Executive Director, TIFAC; Shri Sanjay Singh, Scientist 'G' and Shri Mukesh Mathur, In-charge (F&A), TIFAC were also present on the occasion.

Website link:
https://dst.gov.in/tifac-releases-report-active-pharmaceutical-ingredients-status-issues-technology-readiness-and

Bangalore-based start-up brings mobile app for detection & risk assessment of COVID-19-infected individuals

Novel methods to supplement the early detection of disease and risk assessment of infected population to prioritise the conventional testing queue through mass screening is a crucial challenge the COVID-19 pandemic has thrown up. Combating the crisis needs technological solutions that can carry this out rapidly while minimizing risk for healthcare professionals.

The Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH), an initiative by the DST, has selected Bangalore-based start-up Acculi Labs to develop a COVID risk assessment profile called Lyfas COVID score. Acculi Labs is armed with 'Lyfas' a clinical-grade, non-invasive, digital functional biomarker smartphone tool for screening, early detection, root cause analysis, acute event risk assessment, prognosis, and home monitoring of chronic diseases which they have repurposed to Lyfas COVID score.

CAWACH, an initiative by the National Science & Technology Entrepreneurship Development Board (NSTEDB), DST, is supporting market-ready innovations for the control of COVID-19 and start-up ideas to address associated challenges.

The new technology developed with support from the DST will detect the possible infection in an asymptomatic individual to prioritise the conventional testing queue as well as carry out risk assessment of an asymptomatic individual to become symptomatic and risk assessment of an asymptomatic individual for recovery.

Website link:
https://dst.gov.in/bangalore-based-startup-brings-mobile-app-detection-risk-assessment-covid-19-infected-individuals

JNCASR scientists devise adaptive model to estimate & strategize critical resources in pandemic

Healthcare in a country faces a catch-22 situation in the early stages of an epidemic – specific and accurate tests are required to trace and isolate the infected, and to scale up the novel tests, one needs to have estimates of the expected number of infections weeks to months in advance. And then, these numbers need to be used to predict healthcare inventory requirements in every district of the nation. How does one use models for these estimates when the inputs to the models could be rampant with uncertain parameters?

Scientists from Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous institute under the DST, and Indian Institute of Science (IISc) have developed a model to address this problem using an adaptive strategy and the early phase of COVID-19 as an example.

The model can be utilized to estimate key aspects of medical inventory requirements, a calculation that is required to scale up both the testing capabilities and the critical care facilities, which are essential to reduce the mortality. It would be extremely relevant for COVID-19,

as the disease character and the behavioural patterns of the people change and affect the efficacies of disease spread and management in a second-wave, requiring constant alertness on the part of the forecasters.

Website link:
https://dst.gov.in/jncasr-scientists-devise-adaptive-model-estimate-strategize-critical-resources-pandemic

IIT, BHU to re-purpose approved drugs from DrugBank database for treating COVID-19 by targeting SARS-CoV-2 main protease

The Science and Engineering Research Board has approved support for a research at IIT (BHU) Varanasi to identify lead compound(s) from available and approved drugs for fast-track anti-SARS-CoV-2 drug molecule.

Scientists and healthcare professionals over the world are trying for a cure for the pandemic, which afflicts the world today. At present, available treatments are focused only on symptomatic relief to help the patient overcome the infection. Repurposing of pre-existing drugs could help circumvent both the time and money required to find an effective cure.

The research group of Prof. Vikash Kumar Dubey is working on developing new drug candidates against SARS-CoV-2 by exploring DrugBank (DrugBank is a database of FDA-approved drug compounds. This database will be used for searching drug against SARS-CoV-2) database compounds as an inhibitor of SARS-CoV-2 main protease, a key enzyme required for SARS-CoV-2 assembly and multiplication. They will be carrying out extensive computational and experimental studies to identify an inhibitor of SARS-CoV-2 main protease.

Website link:
https://dst.gov.in/iit-bhu-re-purpose-approved-drugs-drugbank-database-treating-covid-19-targeting-sars-cov-2-main

DST Secretary addressed Rajasthan STRIDE Virtual Summit

Professor Ashutosh Sharma, Secretary, DST stressed on the need to examine and strengthen the knowledge chain end-to-end to see how Science & Technology will lead to Atmanirbhar Bharat, while speaking at the Rajasthan STRIDE Virtual Conclave an initiative by the Department of Science & Technology, Govt. of Rajasthan. It was organized on 30th May 2020.

"We need to examine knowledge chain to see how S&T will lead to Atmanirbhar Bharat…. Since there is a call for Atmanirbhar Bharat or self-reliance, it has to be responded with global quality. To become self-reliant, we have to build up on the strengths of India, which are its R&D, Design, workforce, huge markets, demographic dividend, its diversity, and data," he said.

Focusing on Science, Society and Self-reliance, Professor Sharma, touched upon the learnings from the COVID-19 crisis. "In the last two months, great things have happened in terms of bringing solutions for COVID-19, be it designing world-class ventilators or new diagnostic methods. All this has happened because of a clear and present understanding of our needs & priorities and a problem-centric approach which involved both academia and industry as partners. We can build on our strengths and the lessons of COVID-19 with speed and scale by strongly connecting our knowledge generation systems with knowledge consumption for the benefit of both." he said.

Website link:
https://dst.gov.in/we-need-examine-knowledge-chain-see-how-st-will-lead-atmanirbhar-bharat-dst-secretary-rajasthan

Innovative disinfection & sanitization solutions by common people selected in NIFs Challenge COVID-19 Competition (C3)

National Innovation Foundation – India (NIF), an autonomous body of the DST, has recently supported two innovative disinfection solutions by common people which were received as a response to its Challenge COVID-19 Competition (C3).

A Vehicle Disinfectant Bay and a Foot-operated Height Adjustable Hands-Free Sanitizer Dispenser Stand are the two recently supported innovations under the campaign.

The Vehicle Disinfectant Bay is a device to disinfect vehicles automatically, which reduces time and energy by completing the disinfection process of a vehicle in a very short time without much effort. It consists of a frame, tank, motor, MCB Board, agronet, nozzles, valves, pipes, and fittings and works on the principle of spraying disinfectant liquid by using an AC motor technology for operation. It can be deployed easily at State Border/Checkposts, which are the entry point of vehicles in a State. It is already installed at two checkposts in the State of Sikkim - Rangpo Checkposts, East Sikkim and Melli checkposts, South Sikkim.

The foot-operated Height Adjustable Hands-Free Sanitizer Dispenser Stand is an ideal ubiquitous hygiene solution for residential, commercial, and industrial applications wherein one simply needs to press with the foot a pedal, and the sanitizer will be dispensed. Its height is adjustable as per sanitizer bottle size, and it is steel epoxy powder coated. It also has non-skidding rubber shoes and has a special bottle holder made of high quality elastic. It can be deployed at malls, airports, theatres, banks, business parks, factories, educational institutions, bus depots or railway Stations, hotels, restaurants, and so on. It is being commercialized by Mumbai-based Vissco Rehabilitation Aids Pvt. Ltd, a leading manufacturer of orthopaedic products and mobility aids.

Website link:
https://dst.gov.in/innovative-disinfection-sanitization-solutions-common-people-selected-nifs-challenge-covid-19

NCVTC to develop of host-directed antivirals for COVID-19

The Science and Engineering Research Board (SERB) has approved support for a study by the National Centre for Veterinary Type Cultures (NCVTC), ICAR-NRC from Hisar in Haryana, which will screen their library of 94 small molecule chemical inhibitors for antivirals against coronaviruses.

The molecules are known to inhibit cellular kinases, phosphatases, and epigenetic regulators such as histone methyl transferase, histone deacetylase, and DNA methyl transferase. The targets of these inhibitors are well characterized in cancer, however, their role in the virus life cycle is not known. The selected candidates (hits) with anti-coronavirus activity will be subjected to study their molecular mechanism of action, besides examining generation of potential drug-resistant virus variants.

Classically, antiviral drugs are developed by directly targeting certain viral proteins. However, this strategy often fails due to the rapid generation of drug-resistant viruses. Unlike higher organisms, a viral polymerase-the viral enzyme that synthesizes its nucleic acid (RNA) does not have proofreading capacity. Therefore, RNA viruses such as the coronaviruses do not have the mechanisms to remove wrongly incorporated nucleotides (building blocks of viral RNA) during the synthesis of the viral genome. The lack of proofreading capacity results in the accumulation of point mutations in the viral genome. This leads to changes in viral proteins. The altered viral proteins may then become resistant to the available antiviral drugs. This

intriguing ability of the viruses to rapidly and frequently change themselves is a big challenge for the scientists in developing antiviral drugs.

Website link:
https://dst.gov.in/ncvtc-develop-host-directed-antivirals-covid-19

Sree Chitra Tirunal Institute joins hands with Tata Sons to augment production of COVID-19 testing Kits

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) has entered into a partnership agreement with Tata Group for commercial production of COVID-19 testing kits. The kits will be based on RT-LAMP (Reverse Transcriptase Loop-Mediated Amplification) technology for COVID-19 detection, which can produce results in significantly less time, thereby increasing the throughput of labs in India. The tests are expected to get approval shortly, and production will commence soon after.

The RT-LAMP is a futuristic technology that can be adapted for a point-of-care setting. The 'Chitra Gene LAMP-N' test uses an isothermal setup to create copies of viral DNA for detection, which significantly reduces the complexity of the overall process compared to the prevalent Real-Time PCR technology. Additionally, the test also uses proprietary magnetic nanoparticle-based RNA extraction, which gives a highly purified and concentrated level of RNA from the swab sample.

"The mass production of RT-Lamp-based COVID-19 testing kits with the active support of the Tata Group will be a significant milestone for the Institute. I would like to commend the efforts of the research & development team of the Institute and the Tata Group in building this partnership at this critical time to serve the needs of the nation," said Dr VK Saraswat, Member Niti Aayog and President, Sree Chitra Tirunal Institute for Medical Sciences and Technology.

Website link:
https://dst.gov.in/sree-chitra-tirunal-institute-joins-hands-tata-sons-augment-production-covid-19-testing-kits

COVID-19 testing & research lab at IASST will help treat positive cases early & combat the disease in North East

Institute of Advanced Study in Science and Technology (IASST), Guwahati, an autonomous institute of the (DST, in coordination with Guwahati Medical College & Hospital (GMCH) and National Health Mission has set up a COVID-19 testing and research laboratory. The lab will not only help identify and treat positive cases at an early stage but can also trigger collaborative research on the disease.

Inaugurating the laboratory, Dr Himanta Biswa Sarma, Minister, Health, Education, and Finance, Govt. of Assam said that this laboratory with a capacity of 1000 tests per day will boost the Government's fight against COVID-19. A higher testing rate will reduce the institutional quarantine duration for negative cases and will help to provide treatment to the positive cases at an early stage. Dr Sarma also expected that this facility would provide a unique platform to carry out collaborative research work between faculty of IASST and GMCH.

Website link:
https://dst.gov.in/covid-19-testing-research-lab-iasst-will-help-treat-positive-cases-early-combat-disease-north-east

SCTIMST provides voluntary service in efforts to combat COVID-19

With the COVID-19 virus threat continuing to be a cause for concern, various employee organizations at the Sree Chitra Tirunal Institute of Medical Sciences and Technology (SCTIMST) joined hands to kick-start social service initiatives on a massive scale.

The employee bodies rallied under a single umbrella and initiated a WhatsApp group in a bid to provide the much-needed support to COVID-19 infected staff and those on quarantine, making sure that food, medicine, and groceries were made available to the quarantined staff.

Transportation to staff working in COVID-19 labs and delivery of HCQ to quarantine staff was also ensured without any hassle. 'buddies@sctimst,' a WhatsApp group, took over coordination of volunteer work at all levels. The digital network helped in identifying service requirements for all people, irrespective of their designations.

Website link:
https://dst.gov.in/sctimst-joins-hands-provide-voluntary-service-efforts-combat-covid-19

DST building resilience of SC & STs against COVID-19 through S&T interventions

The Science for Equity Empowerment and Development (SEED) division of the DST is providing grant-in-aid support to several Knowledge Institutions (KIs) and Science and Technology (S&T)-based Non-Government Organizations (NGOs) for the holistic development of SC and ST communities to help them tide over the nationwide lockdown that affected their livelihood and economic condition.

The national lockdown had crippled mobility and human contact to an extent that it has presented a unique challenge to effectively respond to the needs of the SC and ST communities at grassroots. Besides, pre-existing challenges related to health, compromised dietary practices, poor affordability, low educational levels, and lack of awareness calls about healthcare and social services pose obstacles to reach relief and rehabilitation measures to the communities.

The support provided to the network of KIs and S&T-based NGOs by the SEED division has brought convergence among different stakeholders, especially the NGO network with grassroots presence and knowledge organizations, and they are working closely with these communities for implementing effective response, recovery and resilience strategies.

Website link:
https://dst.gov.in/dst-building-resilience-sc-sts-against-covid-19-through-st-interventions

Research proposals invited for COVID-19 for bilateral collaboration in science between India & Australia

Hon'ble Prime Minister of India Shri Narendra Modi and the Hon Scott Morrison MP, Prime Minister of Australia jointly announced a Special COVID-19 Collaboration in 2020 during an India-Australia Leaders' Virtual Summit on 04 June 2020.

Accordingly, the DST and Department of Industry, Science, Energy and Resources (DISER), Australia have invited joint research projects on COVID-19 from interested scientists and researchers under the Australia-India Strategic Research Fund (AISRF), a platform for bilateral collaboration in science, jointly managed and funded by the governments of India and Australia. The research proposals are expected to focus on antiviral coatings, other preventive

technologies, data analytics, modelling, AI applications, and screening and diagnostic testing as priority areas. The project duration would be for 12 months with maximum extension of 6 months.

Website link:
https://dst.gov.in/research-proposals-invited-covid-19-bilateral-collaboration-science-between-india-australia

ARCI & Mekins develop UVC-based multipurpose disinfection cabinet for containing surface contamination of COVID-19

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), an autonomous R&D Centre of Department of Science and Technology (DST), Govt. of India and MEKINS Industries have co-developed a UVC-based Cabinet for disinfecting non-critical hospital items, laboratory wear, and PPEs in the research laboratories to prevent surface contamination of COVID 19.

It can also be used to disinfect items exhibited to customers in commercial establishments and several domestic items.

India was successful in controlling the spread of COVID 19 caused by the SARS COV2 virus during the first few phases of lockdown due to strict implementation of COVID 19 guidelines. But, with relaxation of the lockdown, there is a chance of slow spread of disease due to the movement of people across the country, and this is predicted to continue for some time. Transmission through surface contamination is an unpredictable risk in which common utilities play a key role.

Website link:
https://dst.gov.in/arci-mekins-develop-uvc-based-multipurpose-disinfection-cabinet-containing-surface-contamination

DST releases information brochure on health & risk communication programme focusing on COVID-19

The NCSTC has released an information brochure for a recently launched programme on health and risk communication 'Year of Awareness on Science & Health (YASH) with focus on COVID-19'. The brochure carries information on the genesis and need of such a mega programme in the country to address the issues of risks, crises, disasters, and uncertainties especially posed by the COVID-19 pandemic. The programme focuses on enhancing public understanding and awareness on science and health for better preparedness to cope with the present and future challenges.

Prof. Ashutosh Sharma, Secretary, DST said that a wide array of programmes and activities built around awareness and outreach have been envisaged involving print, electronic, digital, folk and interactive media to reach out to large cross-sections of the society under the campaign. He added that the logo of the YASH programme given on the brochure has been designed to create a wave of peace and bliss and depicts a sense of overcoming the situation at large and would act as a harbinger of taking forward the messages of science, health, risk and awareness.

Website link:
https://dst.gov.in/dst-releases-information-brochure-health-risk-communication-programme-focusing-covid-19

Kerala start-up ties up with SCTIMST to launch IoT-based used mask disposal smart bin & UV light-based disinfection device to beat COVID-19

VST Mobility Solutions, a start-up headquartered at Cochin, has launched an automated mask disposal machine as part of efforts to develop products helping to combat the COVID-19. The disposal device, named BIN-19, developed Chitra UV-based face mask disposal bin technology from the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram, an institute of national importance under the DST, was formally launched by Ernakulam District Collector S. Suhas by installing a unit at his office, the administrative headquarters of the district.

The IoT-based BIN-19 (Internet of Things) is used for collecting and disinfecting used face mask. The device has been subjected to a series of successful microbiological tests by Sree Chitra Lab. Sree Chitra is one of the testing agency for UV-based devices in the country as per the guidelines of the Indian Council of Medical Research (ICMR).

Website link:
https://dst.gov.in/kerala-start-ties-sctimst-launch-iot-based-used-mask-disposal-smart-bin-uv-light-based-disinfection

SERB-supported study shows that collapse of respiratory centre in the brain may cause breakdown of COVID-19 patients

The team of researchers at CSIR-Indian Institute of Chemical Biology (IICB), Kolkata has explored the neuro-invasive potential of SARS-CoV-2 and suggested that the virus may infect respiratory centre of the brain and attention should be focused on the respiratory centre of the central nervous system to search for mortality due to COVID-19.

The paper published in ACS Chemical Neuroscience and supported by Science & Engineering Research Board (SERB), a Statutory Body of the DST, implies that SARS-CoV-2 virus might enter the human brain through the nose and reaches the olfactory bulb of the brain. From there, the virus might infect PreBötzinger complex (PBC), the primary centre of the brain that controls the respiratory rhythm generation. This explains that collapse of the respiratory centre in the brain may be responsible for breakdown of COVID-19 patients.

Website link:
https://dst.gov.in/serb-supported-study-shows-collapse-respiratory-center-brain-may-cause-breakdown-covid-19-patients

COVID Diagnostic Training Centre at JNCASR kicked off crash course in molecular diagnosis of infectious diseases focusing on COVID-19

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), an autonomous research institute under the DST, had established a state-of-the-art COVID Diagnostic Training Centre at its Jakkur campus to help build capacity for the national fight against COVID-19 pandemic.

Molecular diagnostic techniques, such as the real-time PCR, play a crucial role in the diagnosis and tracking of epidemics, including COVID-19. Unfortunately, India lacks personnel skilled in and adept at performing a real-time PCR in clinical diagnostics. Appreciating the crucial and unmet needs of the nation, JNCASR has embarked upon a campaign by establishing a state-of-the-art diagnostic training facility to train personnel in a real-time PCR for COVID-19. The

primary objective of the programme is to train multiple batches of trainees, 6-10 trainees per batch, in real-time PCR.

Website link:

https://dst.gov.in/covid-diagnostic-training-centre-jncasr-kicks-crash-course-molecular-diagnosis-infectious-diseases

RRI comes up with simulation toolkit to ensure safety in secure quantum communication platforms

The advisories by the Ministry of Home Affairs to ensure online communication via secure platforms have highlighted the increasing need for measures to ensure security in the virtual world as COVID-19 confines most day-to-day activities to the digital space.

The secure part of any information transfer protocol is in the distribution of the key used to encrypt and decrypt the messages. Such standard key distribution schemes, usually based on mathematical resolution of problems, are vulnerable to algorithmic breakthroughs and possibility to run new codes on the up and coming quantum computers. The solution to ensuring the security of the key transfer process lies in using the laws of quantum physics, wherein any eavesdropping activity will leave tell-tale signs and hence will be easily detected. This is achieved by using Quantum Key Distribution or QKD.

To tackle this challenge, researchers from Raman Research Institute (RRI), an autonomous institute of the DST, have come up with a unique simulation toolkit for end-to-end QKD simulation named as 'qkdSim', which is based on modular principles that allow it to be grown to different classes of protocols using various underpinning technologies. The research led by Prof. Urbasi Sinha and her team, in collaboration with Prof. Barry Sanders from the University of Calgary, Canada is a part of the Quantum Experiments using Satellite Technology (QuEST) project, India's first satellite-based secure quantum communication effort, supported by the Indian Space Research Organisation (ISRO). This work is going to appear in the journal Physical Review Applied (in press).

Website link:

https://dst.gov.in/rri-comes-simulation-toolkit-ensure-safety-secure-quantum-communication-platforms

NIF supports tea dehydration machine & agar wood oil extraction machine of serial innovator from tea gardens of Assam

Durlobh Gogoi is a small tea garden owner from Assam who was recognized by National Innovation Foundation (NIF) for developing Reciprocating Tea Dryer and other machineries. He has utilized the COVID-19 lockdown period to work vigorously on new ideas – a tea dehydration machine and an agar wood oil extraction machine, to reap the benefits of agar wood expanse in his hometown. Over the last few years, ever since the innovation has become part of NIF's database, it has been incubated and supported for value addition and product development activities.

The NIF, an autonomous institute of the DST, recognized Gogoi's efforts at the National Grassroots Innovation Award Function in the year 2019.

The tea industry in Assam is nearly 200 years old. However, the trend of small-holding tea plantation started in Assam much later – in the 90s – and came with its own set of prospects and constraints. Prospects for profitability, but constraints in terms of machinery to process the produce, as all leading manufacturers of that time were large enterprises.

Website link:

https://dst.gov.in/nif-supports-tea-dehydration-machine-agar-wood-oil-extraction-machine-serial-innovator-tea-gardens

Dr Harsh Vardhan lauded efforts of the DST and its AIs

Union Minister of Science & Technology, Health & Family Welfare and Earth Sciences Dr Harsh Vardhan interacted with Heads of all Autonomous Institutions (AIs) and Subordinate offices of the DST via Video Conferencing on the occasion of 49th DST Foundation Day about their S&T initiatives, particularly in relation to their endeavours for combating the COVID-19 outbreak. "DST & its Autonomous Institutions elevated science and technology in India to international levels," he said. -

The Minister also launched "COVID KATHA", a multimedia guide on COVID-19 on the occasion. As DST enters 50 years of serving the nation through Science & Technology, the Golden Jubilee Celebrations were also launched, initiating myriad activities in different parts of the country through the year.

Secretary (DST), Professor Ashutosh Sharma highlighted the major initiatives of DST, its vision for next five years and the steps DST is taking to identify and map technologies from R&D labs, academic institutions, start-ups, and MSMEs to fund nearly market-ready solutions for diagnostics, testing, healthcare delivery, equipment and supplies to combat COVID-19.

Senior scientists and officials from National Science & Technology Entrepreneurship Development Board (NSTEDB), Science for Equity, Empowerment & Development (SEED) and from Statutory Bodies like Science and Engineering Research Board (SERB), Technology Development Board (TDB) and the Survey of India (SoI) spoke about the different initiatives being taken to tackle the outbreak. Similarly, Directors of Autonomous Institutions like the Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, National Innovation Foundation (NIF), Ahmedabad and S. N. Bose National Centre for Basic Sciences (SNBNCBS), Kolkata spoke about the preparations they have made to brace for the crisis.

Website link:
https://dst.gov.in/dst-its-autonomous-institutions-elevated-science-and-technology-india-international-levels-dr-harsh

Prof. Ashutosh Sharma spoke in live webinar on the occasion of DST's 49th Foundation Day

"The Department of Science and Technology (DST), has undergone tremendous change in recent times evolving into an architect of profound science as against incremental science and the coronavirus crisis is an opportunity to escalate the process," said Professor Ashutosh Sharma, Secretary, DST in a live webinar conversation with Elets Technomedia on 'Fighting Corona - Leveraging Scientific Research & Innovation' on the occasion of its 49th Foundation Day. "COVID-19 crisis demonstrates how DST is rapidly evolving as architect of profound science," he also said.

"We are now designing programmes such that scientists can take risks in doing their science and produce results that would be impactful and can bring about change. Some of these programmes are the Scientific and Useful Profound Research and Advancement (SUPRA) and Intensification of Research in High Priority Areas (IRHPA). Such programmes are changing the way that science is done. The concept and approach of some of these have been adopted in our efforts to find solutions for the COVID 19 crisis rapidly," he said.

Professor Sharma pointed out that some of the DST autonomous organizations have come up with several solutions for different aspects of the multidimensional COVID-19 pandemic within a month and that some of these solutions have emerged in collaboration with private companies and start-ups. So clearly, DST has been catalyzing a change in the process of doing science, and the crisis has come as a ground testing of that change.

Website link:
https://dst.gov.in/covid-19-crisis-demonstrates-how-dst-rapidly-evolving-architect-profound-science-prof-ashutosh

Dr Harsh Vardhan addressed Digital Conference, RE-START – 'Reboot the Economy through Science, Technology and Research Translations

The Union Minister of Science & Technology, Earth Sciences and Health & Family Welfare, Dr Harsh Vardhan said today that India's fight against the COVID-19 is moving fast ahead strongly and steadily. He was addressing a Digital Conference, RE-START – 'Reboot the Economy through Science, Technology and Research Translations', organised to celebrate the National Technology Day here. The Conference was organised by the Technology Development Board (TDB) a statutory body of the DST and Confederation of Indian Industry (CII).

While applauding the Ministry of Science & Technology's response to epidemics like COVID-19 in the country, Dr Harsh Vardhan emphasized that the S&T response reflects the collaborative spirit of the entire S&T ecosystem. "Indian Government, academia, scientists, start-ups, entrepreneurs and industry have been working relentlessly to find solutions to combat this pandemic. We must appreciate the efforts of our scientists, our entrepreneurs and our institutions working to find quick and deployable solutions for COVID-19. New discoveries, industry partnerships, and enhanced researches have thus, been rapidly developed and adopted", said the minister.

"Within a short period of time, the nation has been able to mobilize a number of researchers to develop new testing kits, protective equipment, respiratory devices, etc.", he added. He also said that India is well-poised to reboot the economy through S&T.

Website link:
https://dst.gov.in/india-well-poised-reboot-economy-through-st-dr-harsh-vardhan

Digital conference on rebooting the economy through S&T highlights the importance of collaborations in overcoming COVID-19 challenge

The session on Global Innovation & Technology Alliance for Global Economic Leadership at the digital conference on 'RESTART - Rebooting the Economy through Science, Technology, and Research Translations' organised on the occasion of Technology Day on May 11 highlighted the importance of global collaborations in dealing with the challenge of COVID-19.

The fourth session on Global Innovation & Technology Alliance for Global Economic Leadership in the digital conference had the presence of esteemed dignitaries from India and the world as panellists.

"In today's scenario, virtual collaboration is the key to connect globally to fight against the common challenge of COVID-19. Over the years, the whole area of S&T has moved in a direction where we talk about collaboration, be it national or global & collaboration between countries must continue with much vigour," said Dr Renu Swarup, Secretary, Department of Biotechnology, Government of India while addressing the session.

H.E. Vincenzo de Luca, Ambassador of Italy to India, talked about Italy & India's robust S&T cooperation, which came into force in 2009. He said that it has directly evolved with counterpart Department of Science and Technology (DST), Government of India, to sponsor research. He also mentioned how the regular organisation of joint workshops on topics likes Information & Communication Technology, Sustainable Energy & protection of the environment has also helped build S&T cooperation with India.

Website link:
https://dst.gov.in/digital-conference-rebooting-economy-through-st-highlights-importance-collaborations-overcoming

Digital conference on Rebooting the Economy through S&T discusses transformation of manufacturing companies in post-COVID-19 pandemic

The session on 'Advanced Manufacturing Technologies for Sustainable Future' at the digital conference on Rebooting the Economy through Science, Technology, and Research Translations' organised on the occasion of Technology Day on May 11 discussed how manufacturing companies were undergoing digital transformation due to the COVID-19 pandemic.

"Bringing the Digital and physical world together COVID has forced the Industries who were sitting on the fence to go for digital transformation, which has brought a tremendous change," said Alok Nanda, CEO, GE India Technology Centre.

"We have to look for what is more relevant and near term and become productive using digital thread and computational technology," he added.

Rajiv Bajaj, Managing Director, Stratasys India pointed out that the world is moving towards mass customization and mass specialization today, and technology like 3D printing plays a major role in it. "Traditional manufacturing has some constraints, but 3D printing gives design freedom by shifting the design content from single components to system," he said.

Dr B.B. Ahuja Director, College of Engineering, Pune stressed that additive manufacturing can change the fundamentals of manufacturing, and hence we need to accelerate to adapt this technology in India.

Giving example of the Mechanical AMBU, a low-cost mechanical ventilator developed in his college under a cost of about Rs. 10,000-12,000, he added that creative technology ideas within the country can help solve the supply chain problem.

Website link:
https://dst.gov.in/digital-conference-rebooting-economy-through-st-discusses-transformation-manufacturing-companies

The pandemic is a great opportunity for R&D: Experts at digital conference on Rebooting the Economy through S&T

The session on Medicines & Medical Technologies for better preparedness to face Pandemics at the digital conference on 'Rebooting the Economy through Science, Technology and Research Translations' organised on the occasion of Technology Day on May 11 highlighted that the pandemic is a great opportunity for R&D and needs to be used for strengthening it.

Kalavathi GV, Vice President and Head, Philips Innovation Campus said that devices were needed for easy screening processes, daily monitoring of patients, remote patient monitoring,

diagnosis, pre-set protocol for lung screening, hand-held ultrasound device, electronic ICU, 24*7 clinical capabilities without physical touch, ventilators and other digital technologies and that Philips innovation was getting ready with many of these.

The day-long digital conference which brought together scientists, government officials, academia, and representatives of industry was organized by Technology Development Board, an autonomous organization of the DST along with Confederation of Indian Industry.

The COVID-19 crisis has unfolded some of the best medical advancements and innovations in history like drug discovery, vaccines, and diagnostic tools, and other medical devices, as well as ways to preserve electronic health records. Experts pointed out how these medical innovations can be harnessed for better preparedness to face future pandemics.

Website link:
https://dst.gov.in/pandemic-great-opportunity-rd-experts-digital-conference-rebooting-economy-through-st

Research should be brought closer to the Industry: Experts at digital conference on Rebooting the Economy through S&T

The session on Conference on Advanced Materials at the digital conference on 'Rebooting the Economy through Science, Technology and Research Translations' organised on the occasion of Technology Day on May 11 highlighted that to tackle pandemics like COVID-19 research needs to quickly switch over from being capital-intensive to knowledge-intensive and should be brought closer to industry.

"The strategy for CSIR is to shift from capital intensity to knowledge intensity of research, and we wish to become knowledge partners of many industries. CSIR has tied up with all the major industries for anti-COVID-19 strategies that we have come out with," said Dr Shekhar C Mande, Director General, CSIR.

The day-long digital conference which brought together scientists, government officials, academia, and representatives of the industry was organized by Technology Development Board, an autonomous organization of the DST along with Confederation of Indian Industry.

Speakers at the session agreed that the novel materials such as smart materials, special purpose alloys, engineering polymers & blends, graphene, composites, etc. will be the key to revamping the industry's product lines in the future.

They spoke on how materials are the cornerstones for new-age technology solutions for complex functional problems. Research workers across the world are engaged in developing novel materials designed with specific properties and engineered to deliver focused functional requirements. Investment in such knowledge-based value-added materials will go a long way in accelerating the economic activities and ensuring an attractive return for the industry, they said.

Website link:
https://dst.gov.in/research-should-be-brought-closer-industry-experts-digital-conference-rebooting-economy-through-st

Knowledge Organizations focus on initiatives for socioeconomic rejuvenation and resilience using S&T during COVID-19 pandemic

Knowledge Organizations across the country have started creating scientific awareness on COVID-19 using social, print and electronic media and have started initiatives for building

resilience at community level during and post lockdown period in response to the advisory issued by the DST as part of their Scientific Social Responsibility (SSR).

DST-funded labs CSIR-NBRI, ICAR Labs, Chandigarh University, Manipur University, SKAUST, Srinagar, and Baba Farid University of Health Sciences, Faridkot, Punjab contributed their knowledge and resources for the development and distribution of sanitizer as per World Health Organization (WHO) guidelines, mask preparation as per the guidelines issued by Principal Scientific Advisor (PSA) and services for COVID-19 testing.

A mobile App-based regular advisory to pregnant women has been initiated under already on-going projects at AIIMS, New Delhi. Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir (SKAUST), Srinagar initiated a telemedicine facility for monitoring the health of farm animals under on-going projects. In order to address breathing-related issues, a herbal decongestion spray on the principles of Ayurveda has been developed. More than 5000 l of sanitizer has been distributed among migrant population at AIIMS, New Delhi, Safdurjung-New Delhi, Police Department of Haryana, Punjab, and UP and the process is continuing towards the containment of disease. The technology of herbal sanitizer developed under the DST-funded on-going project has been transferred to companies for bulk production and sustaining the supply for public consumptions at an affordable rate, and the protocol has been shared with Voluntary Organizations for distribution at the local level.

Website link:
https://dst.gov.in/knowledge-organizations-focus-initiatives-socioeconomic-rejuvenation-and-resilience-using-st-during

DST supports assistive tools, technologies and techniques to combat challenges faced by Divyangjan & Elderly during COVID-19

The DST has taken several initiatives to mitigate the impact of COVID-19 among Divyangjan and Elderly and identified various challenges faced by them for finding technological solutions.

The organizations supported by Science for Equity Empowerment and Development (SEED) Division of DST have been instrumental in developing various assistive tools, technologies and techniques that are affordable and adaptable to the Indian milieu through its programme on Technology Interventions for Disabled and Elderly (TIDE), for creating inclusiveness and universal accessibility for Divyangjan and Elderly.

Under this programme an e-Tool to create awareness and impart health and hygiene-related information along with education and entertainment to overcome loneliness of the persons with intellectual disabilities due to COVID-19 pandemic has been developed by Rajalakshmi Engineering College, Chennai. This will help the persons with intellectual disability to learn with fun through Tabs and mobiles. The e-Tool can also be converted to other vernacular languages and the Beta Version of the e-tool is used by 200 specially-abled children.

Website link:
https://dst.gov.in/dst-supports-assistive-tools-technologies-and-techniques-combat-challenges-faced-divyangjan-elderly

S&T-based innovative solutions by common people participating in NIFs Challenge COVID-19 Competition (C3) ready to make a difference

The National Innovation Foundation – India (NIF), an autonomous body of the DST has identified several S&T-based innovative solutions through the Challenge COVID-19 Competition (C3),

a campaign which was running from 31st March to 10th May 2020 for engaging innovative citizens to come up with ideas and innovations to tackle the pandemic.

NIF is providing incubation and mentoring support for further dissemination to the generator of the ideas. A foot-operated device for hand sanitization and washing and an innovative sprayer for sanitization are the two recently supported innovations under the campaign.

Shri Mupparapu Raju from Warrangal, Telangana, has designed the foot-operated device for hand sanitization and washing, which is a timely solution in response to need for contactless devices in the prevailing COVID-19 environment. It facilitates dispensing of soap and water by way of operating the device by foot, and not hands. As a result, there is no hand-related contact between the user and sanitizer, soap, or water, which are adequately stored in separate containers as a part of the device. Shri Raju has implemented the device at various locations (Warrangal, Mahabubabad, and others) in the State of Telangana. NIF has extended support to the innovator for value addition and in meeting the production commitments.

Website link:
https://dst.gov.in/st-based-innovative-solutions-common-people-participating-nifs-challenge-covid-19-competition-c3

TDB approved technologies to augment India's efforts to combat COVID-19

Technology Development Board (TDB), a statutory body of the DST, is proactively supporting the efforts of the scientists, technologists, entrepreneurs, and industrialists towards preventing and containing the spread of the COVID-19 pandemic by providing financial support for commercialization of these technologies. In addition, TDB is also scouting for novel solutions for supporting the country's efforts in tackling the healthcare emergency that the world is facing.

TDB, through its evaluation process, has processed a large number of applications under various domains. TDB had approved several projects towards commercialization, which include thermal scanners, medical devices, masks, and diagnostic kits.

Website link:
https://dst.gov.in/tdb-approves-technologies-augment-indias-efforts-combat-covid-19

RNA extraction kit Agappe Chitra Magna launched commercially for detection of COVID-19

The commercial launch of Agappe Chitra Magna, a magnetic nanoparticle-based RNA extraction kit for use during testing for detection of COVID-19 was announced by Dr VK Saraswat, NITI Aayog member and President of Institute body of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) at a programme attended by Prof. Ashutosh Sharma, Secretary, DST, Dr Asha Kishore, Director, SCTIMST, Dr HK Varma, Head, Biomedical technology and scientists of the institute, through video conference.

The RNA extraction kit was developed by Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) along with Agappe Diagnostics Ltd, an in vitro diagnostics manufacturing company based in Cochin.

"The commercial launch of the kit is a major step to make India self-reliant in detecting COVID-19 and can help increase the rate of testing and bring down its costs, a crucial

step for combating the pandemic. It can also be an example of rapid commercialization and implementation of a state-of-the-art technology for the world to emulate," said Dr Saraswat while announcing the launch.

Website link:
https://dst.gov.in/rna-extraction-kit-agappe-chitra-magna-launched-commercially-detection-covid-19

Comfortable face mask designed by CeNS could encourage public to use it for long hours

A team of researchers at Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, an autonomous institute of the DST, have developed a cup-shaped design (patent filed) of the mask that helps to create enough space in front of the mouth while speaking. It has been transferred to a Bangalore-based company for mass production.

This snug fit mask causes no speech distortion, no fogging on glasses, and indeed, packs well all around, leaving practically no room for leakage while breathing. Another important advantage is its high breathability allowing one to wear it without any discomfort. Further, the researchers have chosen the fabric layers such that there is a possibility of deactivating pathogens sheerly by the electric charges that may prevail under mild friction due to the triboelectric nature of the fabric. These advanced-level tests are being carried out.

Website link:
https://dst.gov.in/comfortable-face-mask-designed-cens-could-encourage-public-use-it-long-hours

DST initiates COVID-19 India National Supermodel for monitoring infection transmission & aid decision-making by policymakers

The DST has initiated a COVID-19 Indian National Supermodel to help monitor the future transmission of infection, thus aiding decisions involving health system readiness and other mitigation measures.

While the Government is keeping a close watch on infectivity and mortality, it is imperative to bring in a robust forecasting model for predicting the spread and enhancing disease surveillance. Numerous mathematical models for COVID-19 forecasting and surveillance are being worked out by investigators funded by DST-SERB (Science and Engineering Research Board) and other agencies.

Inspired by India's history of using mathematical models for disaster management planning of metrological events, DST has initiated this exercise to pool in expertise in the field and create one model for the entire country that will be subjected to rigorous tests required for evidence-based forecasting, routinely practiced in weather forecasting communities.

Website link:
https://dst.gov.in/dst-initiates-covid-19-india-national-supermodel-monitoring-infection-transmission-aid-decision

DST-SERB supports study for identification of structure-based potential antivirals against COVID-19

The Science and Engineering Research Board (SERB), under the DST, has recently supported a proposed study by Prof. Pravindra Kumar from IIT Roorkee for identification of structure-based potential antivirals against SARS-CoV-2.

The study to be funded under Intensification of Research in High Priority areas (IRHPA) will search for small molecule inhibitors targeting some of the most important viral replication enzymes. These enzymes are viral proteases (papain-like protease and 3CLprotease), RNA-dependent RNA polymerase (nsp12), and the Methyltransferase or MTase (nsp14). Viral proteases, which are enzymes encoded by the genetic material (DNA or RNA) of viral pathogens, catalyze the cleavage of specific peptide bonds in cellular proteins.

Website link:
https://dst.gov.in/dst-serb-supports-study-identification-structure-based-potential-antivirals-against-covid-19

NCSTC brings out popular COVID Katha in Hindi

The NCSTC, in association with Dr Anamika Ray Memorial Trust, has brought out the Hindi version of the popular multimedia guide for mass awareness carrying important information on A-to-Z of COVID-19 pandemic.

The English version was released earlier. In order to fulfil the great demand of the Hindi version of COVID Katha especially from the Hindi heartland, the Hindi edition has been brought out with added and revised information for the benefit of the people.

Prof. Ashutosh Sharma, Secretary, DST while appreciating the COVID Katha said that the interpretation of science in common man's language is important for awareness amongst laypersons and Hindi being largely spoken language the Hindi version of COVID Katha carries more value. Prof. Sharma said that science cartoons (scientoons) while carrying scientific messages and explaining the health concepts in a simple manner also add humour and amusement during the present health crisis when people feel stressed!

Website link:
https://dst.gov.in/ncstc-brings-out-popular-covid-katha-hindi

Study initiated for low-cost COVID-19 detection kit suitable for storage in less stringent conditions in rural areas

The COVID-19 pandemic has thrown up the novel challenge of setting up rapid diagnostic facilities in remote areas which do not have adequate infrastructure. This calls for low-cost devices that do not require very stringent storage facilities. Scientists have put in a research plan to meet this urgent requirement.

With support from the Science and Engineering Research Board (SERB), a statutory body under the DST, Birla Institute of Technology, Mesra, Ranchi, has initiated a research with the detection of a target protein using bioinformatics tool against which the diagnostic kit has to be developed. This study has taken the special domain of spike protein in consideration for the development of the diagnostic kit.

Website link:
https://dst.gov.in/study-initiated-low-cost-covid-19-detection-kit-suitable-storage-less-stringent-conditions-rural

SCTIMST & IIT Madras start-up set up portable hospital infrastructure for COVID-19

The COVID-19 pandemic has highlighted the need to set up systems to improve health infrastructure, particularly in rural areas. Portable hospitals for detecting, screening, identifying, isolating, and treating COVID-19 patients in local communities could soon be a solution to tackle the increasing demands for health infrastructure.

Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), in collaboration with 'Modulus Housing' a start-up incubated by IIT Madras, has come up with a solution using decentralised approach to detect, manage and treat COVID-19 patients in local communities through portable microstructures.

Website link:
https://dst.gov.in/sctimst-iit-madras-start-set-portable-hospital-infrastructure-covid-19

Forty-nine innovations in 5 focus areas receive Millennium Alliance Round 6 & COVID-19 Innovation Challenge-Awards

The Millennium Alliance Round 6 & COVID-19 Innovation Challenge-Award Ceremony, which recognized 49 innovative solutions in 5 focus sectors of India, highlighted the necessity of building a highly distributed innovation ecosystem.

Announcing that DST will be soon launching a new programme to have highly distributed innovation ecosystem, DST Secretary, Professor Ashutosh Sharma said that to have a start-up doing innovation it is important to have networking, support, seed money, prototyping facility and all of these facilities could be provided outside the physical space of incubators.

Website link:
https://dst.gov.in/49-innovations-5-focus-areas-receive-millennium-alliance-round-6-covid19-innovation-challenge-awards

Awards announced for Indo-U.S. Virtual Networks for COVID-19

Eight bi-national teams consisting of researchers from India and the US have received awards to pursue cutting-edge research in pathogenesis and disease management of COVID-19 through Indo-US virtual networks. The areas of research they will pursue include antiviral coatings, immune modulation, tracking SARS-CoV-2 in wastewater, disease detection mechanisms, reverse genetics strategies, and drug repurposing.

The Indo-US Science and Technology Forum (IUSSTF) announced the awards to eight bi-national teams, consisting of leading researchers from India and U.S for COVID-19 Indo-U.S. Virtual Networks in support of the efforts of the medical and scientific community to find solutions to the COVID 19 pandemic and emerging global challenges. The IUSSTF is an autonomous bilateral organization jointly funded by the Governments of India and the US that promotes Science, Technology, Engineering and Innovation through substantive interaction among government, academia and industry. The Department of Science & Technology, Governments of India and the U.S. Department of States are the respective nodal departments.

Website link:
https://dst.gov.in/awards-announced-indo-us-virtual-networks-covid-19

DST Secretary highlights digital transformation opportunities that emerged from COVID-19 disruptions

Secretary, Department of Science and Technology, Professor Ashutosh Sharma, emphasised that the future is all about convergence of digital technologies and that COVID-19 virus has provided the country opportunity to be part of the change rather than resisting it, at webinar on Digital Transformation in COVID-19.

"Use of digital technologies and machines can take the country to new heights and fulfil the dream of our Prime Minister of Atmanirbhar Bharat," Professor Sharma pointed out. He added

that data is the new water, and we must value data to use it for our progress at the webinar organised by the Standing Conference of Public Enterprises (SCOPE).

Professor Sharma explained that future has been coming to us at a fast pace even before the COVID-19, but the virus has changed everything. It has disrupted every sector and every life beyond imagination. Its impact is on all aspects -- whether it is availability of labour, supply chains, or logistics. However, the more disruptive the challenge, the bigger will be the achievement, and this is a very good time to think where we are and where we want to be.

Website link:
https://dst.gov.in/dst-secretary-highlights-digital-transformation-opportunities-emerged-covid-19-disruptions

DST reaches out to women scientists facing challenges during COVID-19

The pandemic and associated lockdown has affected people in different ways. Due to closure of institutions, woman scientists, especially those working on projects to address societal challenges through S&T solutions, have been facing several challenges in carrying out fieldwork, data collection, surveys required in their projects and other administrative issues such as timely documentation, the release of fellowships and so on. Keeping their needs in mind, KIRAN division of the DST held an online interaction meeting with these women scientists to help them overcome the challenges.

Website link:
https://dst.gov.in/dst-reaches-out-women-scientists-facing-challenges-during-covid-19

Portable sterilization unit using new hybrid sterilization technology can decontaminate PPEs rapidly

Scientists have developed a portable sterilisation unit using a new technology called the hybrid sterilization system that can decontaminate personal protective equipment (PPE) necessary for combating COVID-19, easily and rapidly, allowing them to be used multiple times.

It can be used by health professionals and other COVID warriors for whom PPEs are essential and can prevent generation of hazardous solid waste from PPEs.

IIT Tirupati (IITT) and IISER Tirupati have jointly developed the Portable Optical Cavity Sterilization Unit (POSCU) to provide efficient and rapid decontamination of PPEs and other household items. A working point-of-use sterilization unit has been developed with the support of Science and Engineering Research Board (SERB), a statutory body under the DST.

Website link:
https://dst.gov.in/portable-sterilization-unit-using-new-hybrid-sterilization-technology-can-decontaminate-ppes-rapidly

Canister bag that solidifies infectious secretions like COVID-19 can save health workers from exposure during handling

Infectious secretions from contagious diseases such as COVID-19, tuberculosis (TB), and influenza pose high risk for healthcare workers. Their exposure to the high-risk hazard while handling the waste can soon be controlled with a canister bag that solidifies the secretions rapidly, making disposal safer.

For the safe management of infected respiratory secretions, the researchers at Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) have come up with a method for safe handling and disposal of respiratory secretions in hospitals for ICU patients or those with copious respiratory secretions treated in the wards. They have developed canister bags lined with super-absorbent material containing an effective disinfectant, named "AcryloSorb".

Website link:
https://dst.gov.in/canister-bag-solidifies-infectious-secretions-covid-19-can-save-health-workers-exposure-during

Eleven Indo-US scientist teams selected to jointly scout for COVID-19 solutions

Eleven teams of Indian and US scientists will soon start jointly scouting for out-of-the-box solutions ranging from novel early diagnostic tests, antiviral therapy, drug repurposing, ventilator research, disinfection machines, and sensor-based symptom tracking for COVID-19.

The teams have been selected to take up these initiatives through a rigorous bi-national review process of proposals received for an invitation under COVID-19 Ignition Grants in April 2020 issued by the U.S.-India Science and Technology Endowment Fund (USISTEF).

The USISTEF announced the awards to eleven bilateral teams proposing out-of-the-box, innovative ideas to address the COVID-19 challenge. The USISTEF has been established by the Government of India (through the Department of Science & Technology) and the governments of the United States of America (through the Department of State) for the promotion of joint activities that would lead to innovation and entrepreneurship through the application of science and technology.

Website link:
https://dst.gov.in/eleven-indo-us-scientist-teams-selected-jointly-scout-covid-19-solutions

CeNS surges ahead with COVID solutions & novel nano- and soft-functional materials.

The Centre for Nano and Soft Matter Sciences (CeNS), engaged in materials research at all relevant length scales, with current focus on a variety of metal and semiconductor nanostructures, liquid crystals, gels, membranes and hybrid materials, has recently contributed significantly to the COVID-19 challenge. When the whole world was debating about the effectiveness and breathing comfort of face masks to fight COVID-19, its innovation attracted headlines for their uniqueness. One of them was a cup-shaped design of the mask that helps to create enough space in front of the mouth while speaking. It has been transferred to a Bangalore-based company for mass production.

Website link:
https://dst.gov.in/cens-surges-ahead-covid-solutions-novel-nano-and-soft-functional-materials

Tracking global genetic variability, predicting viral sequences to resolve COVID-19 challenge

A group of scientists in India is working on genomic sequences of SARS-CoV-2 around the World, including India, to identify genetic variability and potential molecular targets in virus and human to find the best possible answer to combat the COVID-19 virus.

Breaking down the novel coronavirus challenge into many pieces to get to its root and see it from multiple directions, Dr Indrajit Saha, Assistant Professor in the Department of Computer Science and Engineering of National Institute of Technical Teachers' Training and

Research, Kolkata and his team have developed a web-based COVID-Predictor to predict the sequence of viruses online on the basis of machine learning and analysed 566 Indian SARS-CoV-2 genomes to find the genetic variability in terms of point mutation and Single Nucleotide Polymorphism (SNP).

Website link:

https://dst.gov.in/tracking-global-genetic-variability-predicting-viral-sequences-resolve-covid-19-challenge

Neurons in the nose & hypothalamus may be entry points of SARS-CoV-2 virus to brain

Scientists have zeroed in on the route in which the SARS-CoV-2 virus makes its way to the brain. Neurons located in the nose that help us sense smell as well as hypothalamus, the small region located at the base the brain, could provide the port of entry for the virus into the brain, says a new study.

The study could provide a new understanding to tackle the COVID-19 patients and control the pandemic, which has caused crisis of unprecedented dimensions affecting every continent of the globe.

Dr Vincent Prevot, previously a principal investigator supported by the Indo-French Centre for the Promotion of Advanced Research (CEFIPRA), supported by the DST along with a team of Indian and French scientists, have shown that specialized glial cell called tanycytes in the hypothalamus as well as olfactory neurons could provide an opening for SARS-CoV-2 into the brain. They have also shown that hypothalamic circuits could act as a hub for the numerous risk factors as well as the physiological effects of viral infection. This work has been published in the journal 'bioRxiv'.

Website link:

https://dst.gov.in/neurons-nose-hypothalamus-may-be-entry-points-sars-cov-2-virus-brain

Lucknow lab records shortest average time to process samples among institutions in India

As the COVID-19 patient numbers are recorded, a testing hub in Lucknow for the disease has recorded the shortest average time to process samples among institutions in the country.

With 1000 to 1200 samples being tested per day, the story of the rise of Birbal Sahni Institute of Palaeosciences (BSIP), an autonomous institute of the DST, to the top institution not only in the state but throughout the country in terms of average processing time of samples is one of sheer grit and dedication.

With a small team of 8 members, the lab is running 24x7 to test samples from various districts of Uttar Pradesh. The number of samples tested by BSIP has crossed 50,000, of which approximately 1600 samples were reported positive for SARS-CoV-2 with zero pendency. Keeping in light the present scenario and to aid the authorities to contain this pandemic, BSIP has provided testing reports (on daily basis) to the concerned districts in record time of 24 hours.

BSIP joined hands with the Government of Uttar Pradesh to combat COVID-19 in the state, becoming one of the five Central Government research institutes in Lucknow, which took initial steps to start laboratory testing of COVID-19. Availability of a BSL-2A laboratory, primarily for ancient DNA work in the Institute, became the advantage needed to immediately prepare for testing.

Website link:

https://dst.gov.in/lucknow-lab-records-shortest-average-time-process-samples-among-institutions-india

Multiple options for COVID-19 detection kits from start-ups on the cards through support of CAWACH Initiative of NSTEDB, DST

India will soon have the option of choosing from several COVID-19 rapid detection technologies that start-ups are working on currently.

A technology to conduct rapid molecular tests at small clinics, points-of-entry like airports, or small laboratories, a lab on palm platform for Rapid Antibody Test and a test kit with a reader-enabling direct antigen testing in suspected COVID samples are some of them.

The technologies developed by some start-ups have been repurposed and extended for COVID-19 with support from the Centre for Augmenting WAR with COVID-19 Health Crisis (CAWACH), an initiative by National Science & Technology Entrepreneurship Development Board (NSTEDB), DST, and implemented by Society for Innovation and Entrepreneurship (SINE), IIT Bombay.

Website link:
https://dst.gov.in/multiple-options-covid-19-detection-kits-start-ups-cards-through-support-cawach-initiative-nstedb

9. S&T in India in Post-COVID-19 Era: Major Lessons

COVID-19 has impacted almost every sector. R&D is no exception. India made some outstanding progress in R&D in last few months. These success stories have unfolded due to an exceptional sharing of purpose, synergy, collaboration and cooperation that R&D institutions, academia and industry have demonstrated in these months. There have also been several compelling lessons from COVID-19 in relation to our R&D.

Based on the experience and learning of last 3-4 months since the COVID-19 was around, following are a few important observations and likely impact of COVID-19 on R&D:

a. Need for having short-duration projects to address immediate challenges and deliver results in shortest possible time. Generally, most of the R&D projects are supported by government agencies for a period of 3 to 5 years. The pandemic posed a new challenge to evolve quick solutions in shortest possible time, more so in case of development of COVID-19-related technologies that need to be delivered to industries for production.

b. The boundaries among private, public, national laboratories, academic institutions are to be dissolved in the cases where a strong collaboration is required for problem solving. In the last few months it has been amply demonstrated that R&D institutions, labs, academia, start-ups and industry when they work together, can come up with solutions in a rapid mode to meet the challenges posed by COVID-19.

c. COVID-19 is likely to have major impact on Domestic and International Travel not just in short term but also in medium terms, say for a period of another 2-3 years. On the positive side, this will conserve resources and time especially on international R&D collaborations. SOPs and new normal for the efficient conduct of remote meetings will be fully evolved.

d. COVID-19 has already impacted the way we used to have meetings and conferences. Having virtual meetings in the form of webinars may become a new normal even after COVID-19

has gone. This is considered as one of the biggest gain to R&D as such virtual meetings help save time, money, and most importantly, ensure greater attendance and participation reaching to much larger audiences that will be a vital factor in democratization of science.

e. COVID-19 may have some impact on field and institutional visits by students, experts and professionals that might become little restrictive in short term, but will improve with time. Infrastructure and processes for remote carrying out of experiments and instructions need to be evolved.

f. COVID-19 may promote more "Profound" research than "Incremental" to achieve multi-fold jump in R&D. That would entail a more risk-taking research.

g. There may be greater alignment with national priorities and programmes for R&D to focus on "Quality" and "Relevance"

h. COVID-19 has impacted science and scientists world over. A large number of People of Indian Origin and NRIs have already expressing their interest to help India in R&D, many of them may also like to return to India. This may be a big "Brain Gain" for Indian R&D.

10. Way forward

DST will retain and institutionalize the best of lessons learned during the time of virus as presented in this document to accelerate the growth and translation of relevant S&T with speed and scale by an early participation of industry/start-ups for an Atmanirbhar Bharat.

Also, the nation will be fully ready to meet any new pandemic of the future much faster and with enhanced effectiveness.

The overarching factors which need to be addressed are:

- Defining clear and present objectives for product and technology needs in different sectors with industry and line ministries.
- Structures and processes for coordination and cooperation among academia, labs, start-ups, line ministries and industry.
- Flexibilities in the structures and processes needed for problem solving with speed and scale.

The interventions needed are:

- Creating a seamless end-to-end knowledge generation/consumption chain from relevant, early direction R&D to translation to design and prototyping to start-ups/industry/market/society by directed partnerships.
- Identification of products/technologies to be developed in health, agriculture, transport, energy, water, environment, digital mapping, education, etc. for their time-bound development with industry partnership.

- Be fully future ready in strong partnership with industry with flexibility required in the emerging areas of Artificial Intelligence and applications; Clean Fuels and energy; Quantum Technologies; and other hybrid Digital-physical Technologies for manufacturing and services, etc.

- Direct and incentivized collaborative approach to problem solving rather than fragmentation of the problem attempted by different scientists/groups.

- Create network of institutions (R&D labs, universities, IITs, industry, start-ups) for developing technologies and products based on national priorities in models such as a tertiary web of Hub, Spokes and Spikes (individual projects that assemble to the big picture).

- Processes for efficient review, monitoring and evaluation of projects that bring in transparency and accountability together with a way forward for the outcomes to reach industry/society.

- Projects/centres/schemes/missions supported should all embed the above elements.

- Incentivize industry R&D participation and facilities for developing critical needs with or without public sector partnership. This includes not only tax breaks, soft loans, interest subvention and grant support for the high risk products, but also preferred market access and conveying a clear intent of the products required by the government.

- A map of technologies and capabilities available with industry, start-ups and academia/labs need creation and constant updating to be able to engage, leverage and activate latent capacity at a short notice.

- The concept of L1 in the government purchases needs to be replaced by the concept of 'Cost to the Nation'. This, for example, takes into account the jobs created and the money retained here versus outside of India.

- Continuation of standing groups of scientists in two critical areas: (1) Modelling and analysis group that will refine their tools to have a robust National Supermodel in readiness so as to make prediction-based decisions; (2) Artificial Intelligence-based hubs for rapid response on diagnostics and planning.

- Continuous mapping of relevant start-up and industry for their capability and capacity, which could be activated at a short notice.

- An extraordinary 10x push to innovation and start-up ecosystem within the next 4 years at 4x of investment by a new scheme on distributed start-ups.

- Creation of an army of highly accomplished start-up mentors who are dedicated to the cause, not necessarily looking for their own financial profit. This plan on a pilot scale is already seeded to help the start-ups that were chosen for funding.

- Digital push in all technologies including effective remote access to R&D infrastructure and human resources.

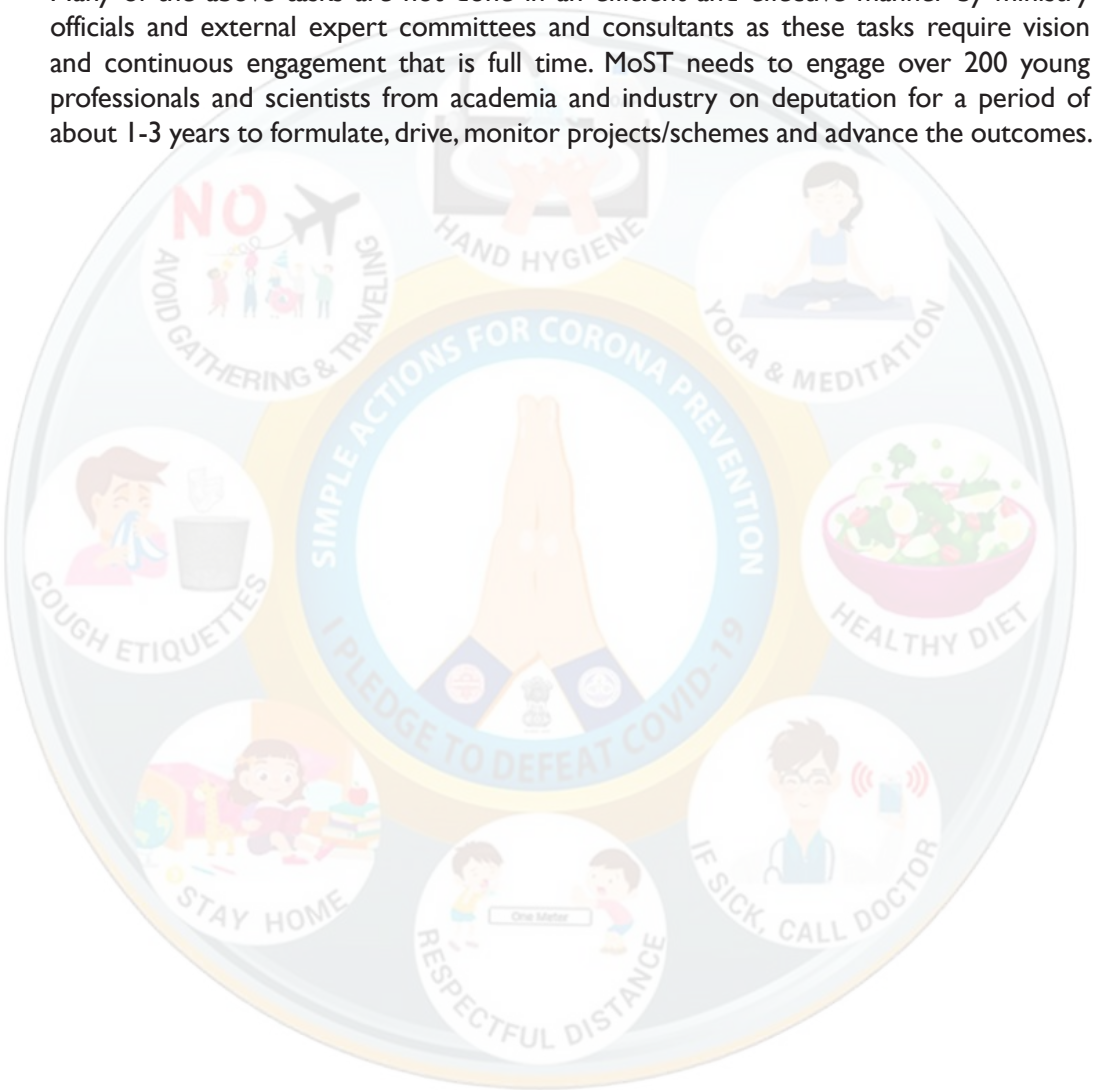
- Creation of technologies for an independent electronic backbone ecosystem.

- Reorientation of PhD research, which is the backbone of R&D and creation of human resources, by training and mentoring and appropriate orientation to make some of them relevant for industry.

- Need far more extensive and strong science communication which reaches and appeals various segments of society.

- Seeking continuous feedback of stakeholders such as scientists, external committees etc. on the effectiveness and functioning of officials and schemes for course corrections.

- Many of the above tasks are not done in an efficient and effective manner by ministry officials and external expert committees and consultants as these tasks require vision and continuous engagement that is full time. MoST needs to engage over 200 young professionals and scientists from academia and industry on deputation for a period of about 1-3 years to formulate, drive, monitor projects/schemes and advance the outcomes.



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