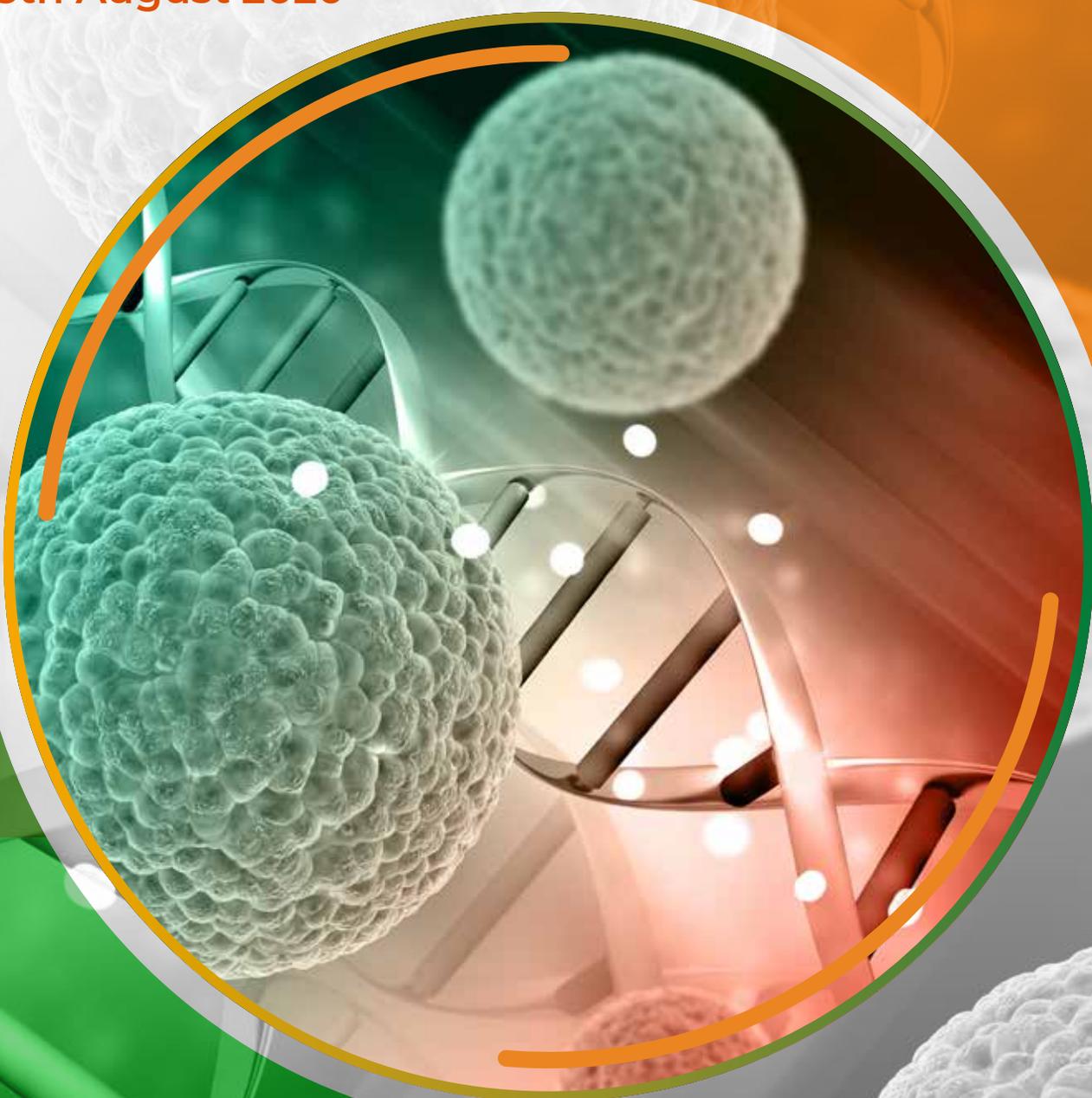


SCIENCE & TECHNOLOGY EFFORTS IN INDIA ON COVID-19

UPDATED FORTNIGHTLY

15th August 2020



Compiled by
VIGYAN PRASAR
An Autonomous Organisation of
Department of Science & Technology,
Government of India



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

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

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

Waving of the national flag by people at rooftops and balconies is among the novel ways of celebrating the spirit of bravery and courage in the face of the novel coronavirus pandemic, according to the latest advisory issued by the Union home ministry for Independence Day celebrations in the country. The COVID-19 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. As we all are adapting to live with coronavirus, and adjusting to new normal of several aspects of our day-to-day life since there is no early tapering off of the disease.

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. 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. Government of India, through its various wings, has invited Calls for Proposals (CFPs) and Expressions of Interest (EoIs), announced various hackathons and challenges, and reached out to general public through various apps, pledges, etc. to enhance research and development-related activities to battle the pandemic out as well as making the nation aware and self-reliant.

The publication of Independence Day Special Edition of the e-Newsletter 'S&T Efforts in India on COVID-19' is conceived as producing an information product related to initiatives implemented towards getting us the freedom from COVID-19 disease and its transmission. The edition consists of the compilation of the developments during the last fortnight as well as the synopsis of all the initiatives taken after the outbreak of the pandemic. 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. The edition is attributed to all the corona warriors helping the humankind.

Vigyan Prasar
New Delhi

Dr Harsh Vardhan announces successful completion of first Pan India 1000 Genome sequencing of SARS-CoV-2

1st August 2020, New Delhi

Dr Harsh Vardhan, Minister for Science & Technology, Health & Family Welfare and Earth Sciences announced the successful completion of PAN-India 1000 Genome sequencing of SARS-CoV-2 here today. In a meeting with Department of Biotechnology (DBT) he reviewed the COVID-19 activities of DBT, Biotechnology Industry Research Assistance Council (BIRAC) and DBT-Autonomous Institutions (AIs).

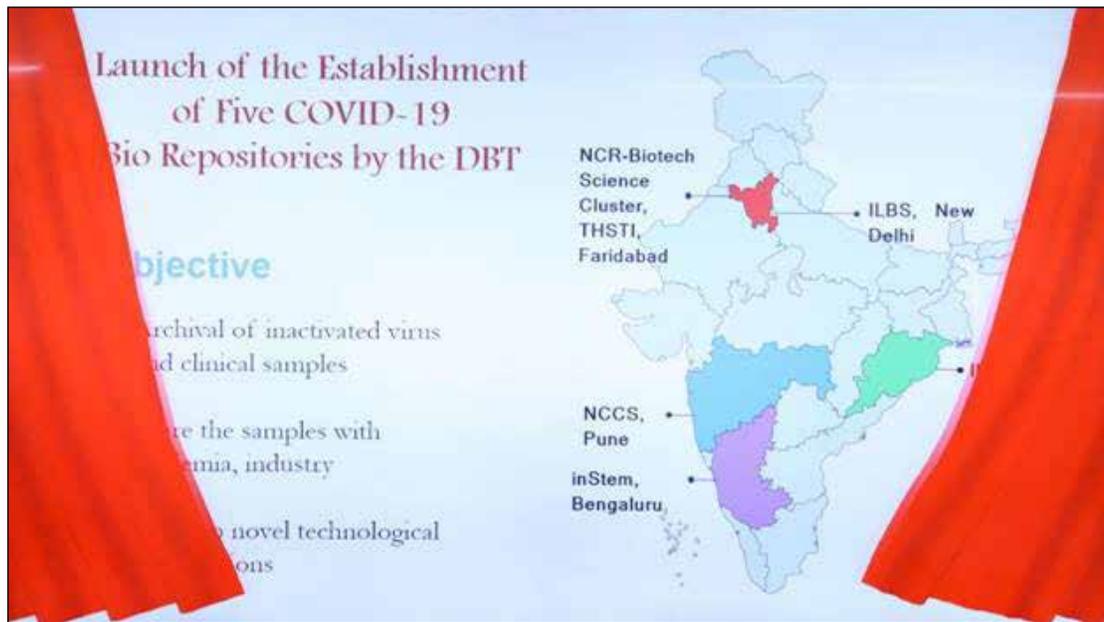
During the meeting, Dr Harsh Vardhan also launched and dedicated to the nation the largest network of five dedicated COVID-19 Biorepositories established by Department of Biotechnology in record time. These are at Translational Health Science and Technology Institute (THSTI), Faridabad; Institute of Life Science (ILS), Bhubaneswar; Institute of Liver and Biliary



Sciences (ILBS), New Delhi; National Centre for Cell Science (NCCS), Pune; and Institute for Stem Cell Science and Regenerative Medicine (InStem), Bangalore. He complemented the efforts of DBT in “the relentless war for mitigation of this Pandemic”.

Dr Harsh Vardhan said, “Given the importance of this information for public health response initiatives requiring investigation into the transmission of COVID-19, the sequence data will soon be released in Global Initiative on Sharing All Influenza Data (GISAID) for use by researchers across the Globe... The information in the database will improve our understanding on how the virus is spreading, ultimately helping to interrupt the transmission chains, prevent new cases of infection, and provide impetus to research on intervention measures.” The Minister also pointed out, “The data analysis, which is ongoing, may bring out some interesting conclusions to help in our fight against COVID-19.”

Dr Harsh Vardhan also highlighted that “16 Vaccine Candidates are in different stages of development. The BCG Vaccine is undergoing phase 3 trial, Zydus Cadila DNA Vaccine is in phase I / II trial and 4 Vaccine candidates are in advanced stages of pre-clinical study. ... Five



Good clinical laboratory practice (GCLP) clinical trial sites have been developed and 6 animal models for Vaccine Development Studies are also ready.”

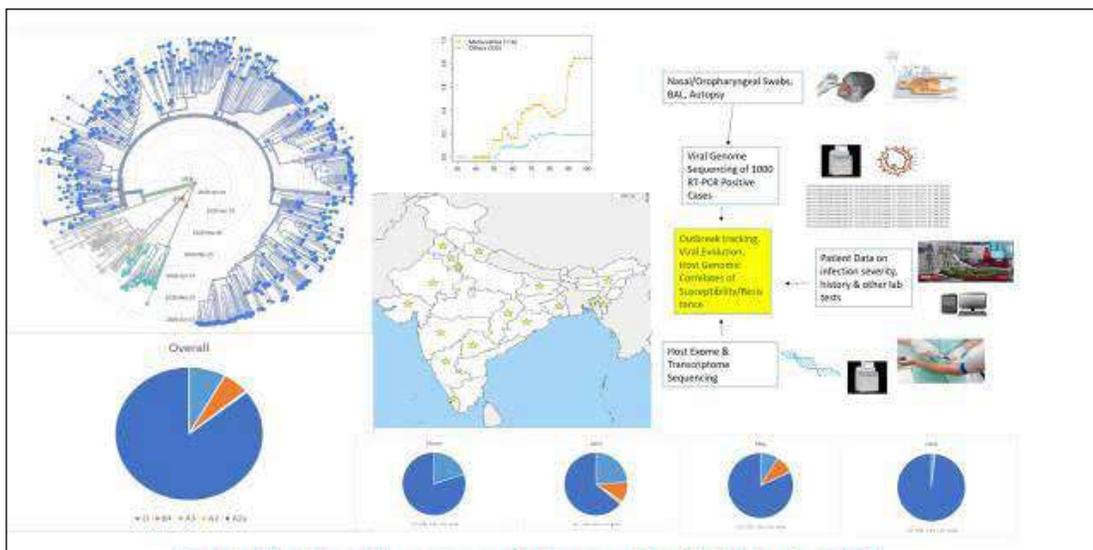
The Department of Biotechnology had launched a Pan India 1000 SARS-CoV-2 RNA Genome Sequencing programme in May this year to be done by Autonomous Institutes of DBT, collaborating with national laboratories and clinical organizations.

The consortium coordinated by National Institute of Biomedical Genomics (NIBMG-Kalyani), West Bengal; and Five other National clusters, ILS-Bhubaneswar; Centre for DNA Fingerprinting and Diagnostics (CDFD)-Hyderabad; InStem; National Centre for Biological Sciences (NCBS)-IISc-Bangalore; and NCCS-Pune are actively participating in sequencing and analysis. Collaborating National Institutes and clinical organizations involved are ICMR - National Institute of Cholera and Enteric Diseases; Institute of Post-Graduate Medical Education and Research (IPGMER), Kolkata; IISc-Bangalore; AIIMS-Rishikesh (Uttarakhand); Maulana Azad Medical College (MAMC)-Delhi; THSTI-Faridabad; Grant Medical College (GMC)-Aurangabad; Mahatma Gandhi Institute of Medical Sciences (MGIMS)-Wardha; Armed Forces Medical College (AFMC); and Byramjee Jeejeebhoy Government Medical College (BJMC)-Pune; and other hospitals.

The Consortium has achieved its initial goal of completing the sequencing of 1000 SARS-CoV-2 genomes from nasopharyngeal and oropharyngeal swabs collected from individuals testing positive for COVID-19 by Real-Time PCR. The samples were collected across 10 states covering different zones within India.

DBT is supporting COVID-19 Bio Repositories through a well-strategized plan so that novel technological interventions can be developed in due course of time. The main purpose of these biorepositories is archival of inactivated virus and clinical samples, including naso-oropharyngeal swabs, stool, urine, saliva, serum, plasma, PBMC and Serum.

These designated biorepositories will use the clinical samples for R&D purpose and are authorized to share the samples with academia, industry, and commercial entities involved in



DBT-AIs Consortium successfully completed Pan-India 1000 Genome Sequencing of SARS-CoV-2

development of diagnostics, therapeutics, vaccines etc., after scrutinising the purpose of the request and ensuring benefit to the country. Standard Operating Procedures (SoPs) for sample collection, transportation, aliquoting, storage and sharing have been developed. As on date, 44452 clinical samples have been collected and stored in these five centres. More than 5,000 samples have been shared.

During the meeting which was attended by Dr Renu Swarup, Secretary DBT, and joined through video-links by Senior officers of DBT and its Autonomous Institutes and Public Sectors BIRAC and BICOL, the Minister was presented an update on the DBT–BIRAC COVID-19 Research Consortia under which more than 150 Research Groups have been supported involving nearly 80 Industry/Academia collaborations, 40 Academic Research Institutes and more than 25 Start-up Research Groups.

The consortium has successfully developed 100 per cent self-reliance for producing more than 5 lakh RTPCR diagnostic kits per day. Four technologies developed by DBT AIs have been transferred to the industry for commercial manufacturing of diagnostic kits. DBT AIs are also providing services for Diagnostic Testing, Kit Validation and Antiviral testing.

Website link:

<https://pib.gov.in/PressReleaseDetailm.aspx?PRID=1642869>

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The Independence Day Special Edition consists of the compilation of the developments during the last fortnight and the synopsis of all the S&T initiatives taken up after the outbreak of the pandemic.

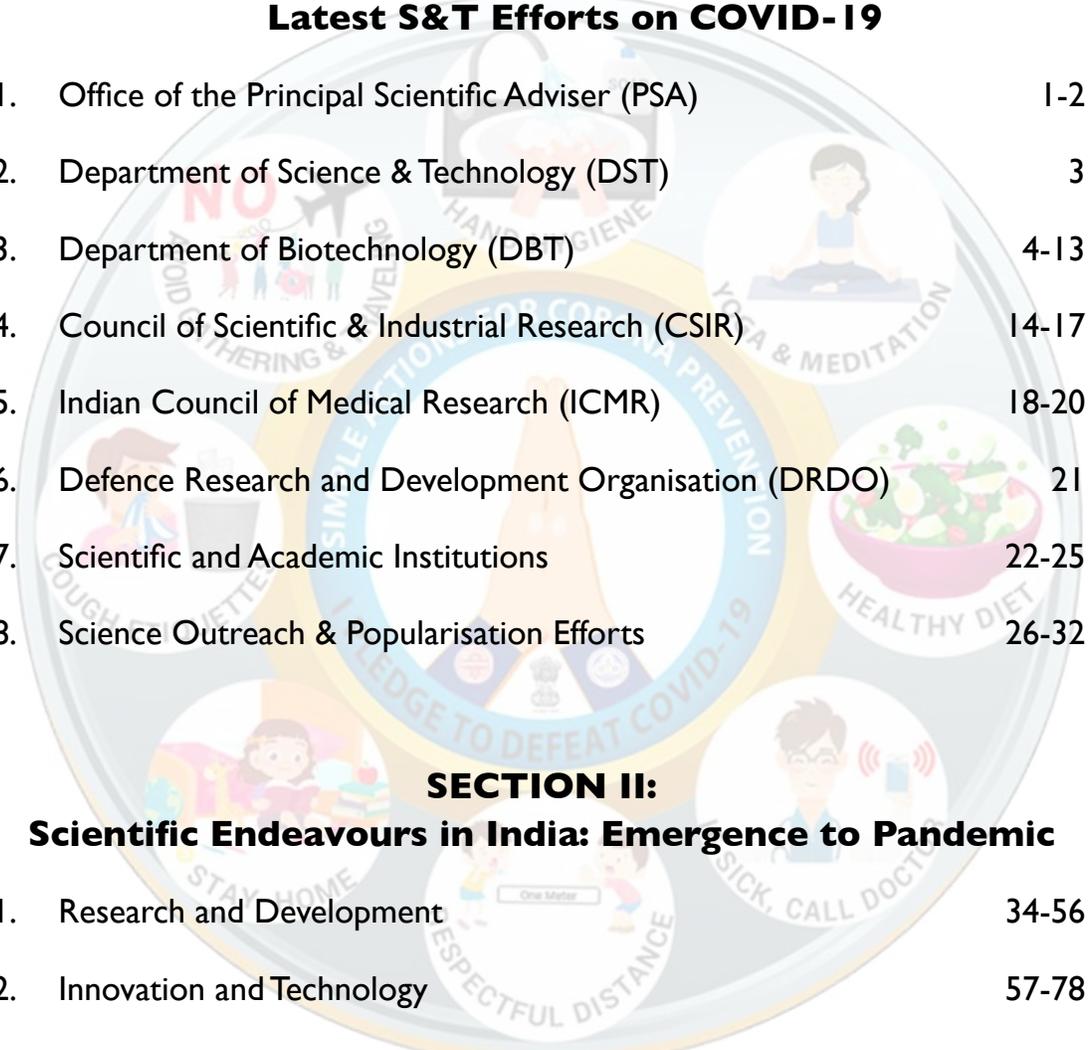
The older issues of e-newsletter are available in the Archival Section at

<https://vigyanprasar.gov.in/covid19-newsletters/>

TOPICS

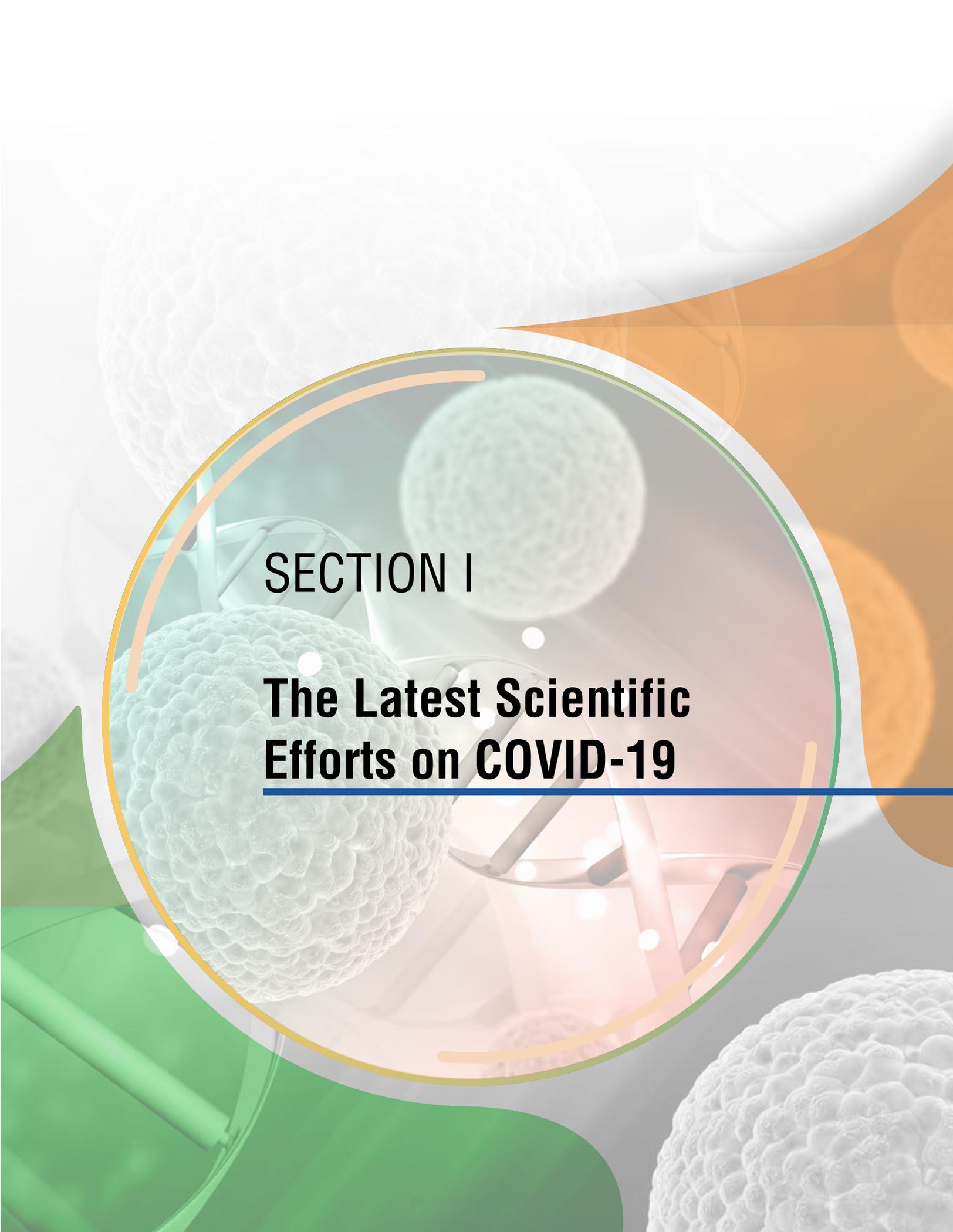
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SECTION I

**The Latest Scientific
Efforts on COVID-19**

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19
BY
OFFICE OF THE PRINCIPAL
SCIENTIFIC ADVISER (PSA)

The Office of the Principal Scientific Adviser (PSA) to the Government of India has launched an initiative called Kisan Mitr. It is a seven-phase project aimed at supporting farmers to become Atmanirbhar (self-reliant). The first and second phases of the initiative were covered in the previous editions of this newsletter dated 23rd July and 30th July 2020, respectively.

PHASE III

The third phase provides a repository of agriculture-related scientific research and technologies that might not be ready for mass production yet, but industry leaders and technology enthusiasts get an early opportunity to see what's around the corner and engage in the development process of the final product. The engagement platform helps research teams and young start-ups to showcase their research and easily engage with industry interest.

The Kisan Mitr platform receives a catalogue of research and technologies supplied by institutions such as IIT, RUTAG, IISER, CSIR, ICAR, MSME, start-ups, Gates Foundation, etc.

Examples of a few research projects on the platform include oil extraction techniques, de-husking techniques, small-scale milling techniques, curing and polishing techniques, storage techniques, production improvement techniques etc.

The Kisan Mitr platform facilitates an engaging exchange between the supply and demand sides through chat, video meetings, rating system, and feedback forms. The platform also bridges the collaboration gap between the research institutes and the industry primarily via competitions in which difficult problems from the industry are posed as a challenge to the scientific community.

To solve the cold-start problem, NASSCOM and NIAM organize weekly webinars and convene both the sides to the platform. DD Kisan is considering televising the agricultural technologies in order to increase visibility and adoption of modern farming techniques and technologies across the country.

PHASE IV

The fourth phase of the project focuses on developing a last-mile supply-chain network for niche (nutritional, medicinal, aromatic, organic, GI tagged) agricultural products cultivated by farmers on the fringes. This phase has been named *Himalayan Bazaar* considering the geographical distribution of the supply-side farmers.

Thousands of FPOs and Women SHGs located in the mountain states, north-eastern states, and tribal areas will be on-boarded to sell their produce on the platform. Small Farmers' Agribusiness Consortium (SFAC) data of thousands of FPOs is currently being used by Kisan Rath app (NIC). The same data is being sought for on-boarding FPOs from mountain states and tribal areas onto the Kisan Mitr digital platform through API integration.

The demand-side will be comprised of charitable trusts and retail aggregators such as IKEA Foundation, ICICI Foundation, Akshaya Patra, Reliance Fresh, and Rotary.

In order to connect the farmers on the fringes with the primary supply-chain network, autonomous unmanned aerial vehicles (UAV) created by ex-ISRO and IISc teams have been proposed as a solution. Using a hub-and-spoke model, these drones can bring smaller quantities of produce from nearby areas to the main hub located near a city. The proposal has been sent to the Ministry of DONER for evaluation.

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The project has received support from various departments of the government, as well as private sector organizations. Website Link: <https://farmer.indiancst.com/>.

The next phases of the initiative will be covered in the subsequent editions of this newsletter.

Contact Info: sapna.poti@gov.in



SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

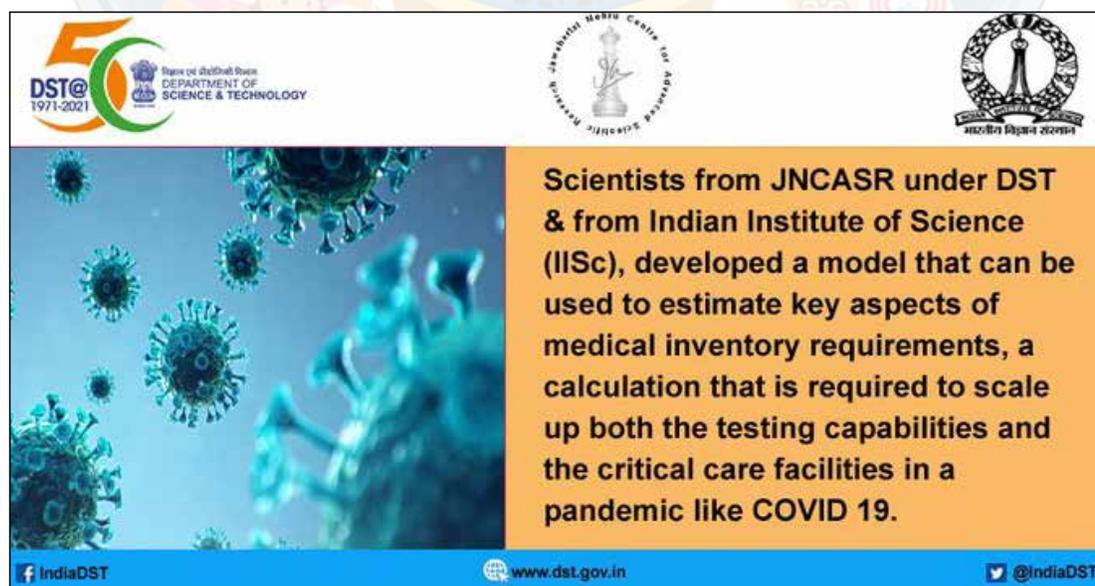
DEPARTMENT OF SCIENCE AND TECHNOLOGY (DST)

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, Government of India, 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.



Scientists from JNCASR under DST & from Indian Institute of Science (IISc), developed a model that can be used 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 in a pandemic like COVID 19.

IndiaDST | www.dst.gov.in | @IndiaDST

Website link:

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

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

DEPARTMENT OF BIOTECHNOLOGY (DBT)

DBT-THSTI develops bioresources to help study COVID-19 pandemic

The DBT's Faridabad-based Translational Health Science and Technology Institute (DBT-THSTI) has established a set of patient cohorts as a part of the National Bioresource Centre for COVID-19, which is an initiative of DBT, its autonomous institutions, and hospitals in Delhi and other parts of the National Capital Region.



The Biorepository facility at THSTI has developed the following COVID-19 Bioresources:

- Standardized well-phenotyped serum panel for testing of antibodies (development and evaluation sera panels);
- Pooled samples to develop calibrators/controls (both positive and negative for SARS-CoV-2 for diagnostic assays);
- Standardized nasopharyngeal/oropharyngeal panels for testing of antibodies; and
- Viral strains and inactivated virus.

Over 4,000 samples have been collected from participants who were suspected of SARS-CoV-2 infection, irrespective of whether they tested positive or negative. Almost 2,000 people who have tested positive are being followed up with about 250 people having given samples 6-10 weeks after being diagnosed.

The THSTI's Biorepository has received 20 requests from academia and industry. It has responded to 12 requests and others are being processed through an external access control committee, established by DBT that independently decides the merit of each application. The requests include those for COVID-19 positive sera and plasma, COVID-19 negative samples, and sera and nasopharyngeal/oropharyngeal swabs in viral transport medium.

In response to the requests, the Biorepository has provided a total of about 2,400 sera samples and 130 naso- and oro-pharyngeal swabs to date. Eight development sera panels (including samples from 100 participants), two naso-oro-pharyngeal panels (75 samples), four evaluation panels (samples from 100 participants), and pooled positive standard and pooled negative standard have been shared.

In addition, DBT-THSTI offers diagnostic performance evaluations, and most recently has evaluated ELISafe 19 IgG ELISA for SARS-CoV-2 developed by Syngene International Ltd/

Himedia for 3 manufacturing batches by a 'beta-testing panel' and a Q-Line IgG Rapid card for SARS-CoV-2 developed by POCT Services Pvt. Ltd. and RGCB by a 'development panel.'

Various SOPs related to the THSTI Biorepository bioresource on COVID-19 are available at https://thsti.res.in/covid_bioresources.php

Contact Info: Dr. Siuli Mitra (smitra@thsti.res.in)

Website link:

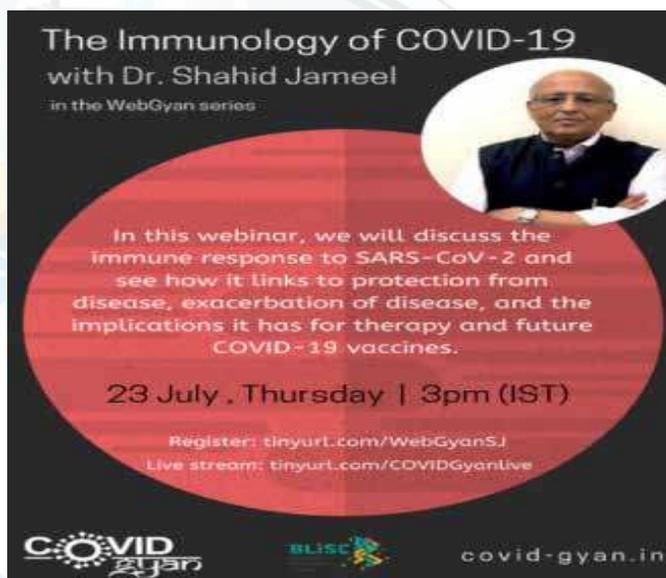
<https://thsti.res.in/>

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_01S_3Aug2020.pdf

DBT-inStem holds outreach webinar on 'Immunology of COVID-19'

The DBT's Institute for Stem Cell Science & Regenerative Medicine (DBT-inStem) is one of the founding partners of COVID Gyan, a pan-institutional website that has been proactive in COVID-19 outreach efforts. It has, among other things, been holding webinars on various aspects of the pandemic.

The sixth session of the COVID Gyan's WebGyan series featured a talk by Dr Shahid Jameel, an eminent virologist and the CEO of the Wellcome Trust DBT India Alliance. The topic of the session held on July 23 was 'Immunology of COVID-19' and focused on the immune response to SARS-CoV-2, how it links to protection from disease, exacerbation of disease, and the implications for therapy and future COVID-19 vaccines.



Dr Jameel began the session by sharing a video, titled 'COVID-19 Immunology 101 for Non-immunologists' prepared by Dr Akiko Iwasaki of Yale University, USA followed by citing the numbers of the pandemic as they stand today globally and then focusing on Indian states. He also highlighted differences in progression with examples of urban hubs such as Delhi, Mumbai and Bengaluru; structure of the viral genome; nature of infection and disease transmission, types of possible vaccines (DNA, RNA, viral vector etc.); and the current status of SARS-CoV-2 vaccines. He noted that the coronavirus family carries proof-reading activity, so the virus strains don't change as fast as other RNA viruses.

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He applauded the dedication and relentless work of the scientific fraternity towards the R&D effort in fighting COVID-19 and emphasized that vaccines, once released will be used based on need and severity especially for frontline workers like medical practitioners, followed by senior citizens and co-morbid groups and so on. He reiterated the need to practise personal safety by wearing facemasks and avoiding public/crowded spaces. He concluded his talk by stating that more pandemics will affect the human race due to mindless human interference with nature in the form of deforestation, wildlife trade, and global warming and stressed the need to promote a sustainable, healthy, and eco-friendly lifestyle.

The 100 minutes session was moderated by Prof. Rajesh Gopakumar, ICTS-TIFR, Bangalore and Sandhya Koushika, TIFR-Mumbai. It was live streamed on COVID Gyan YouTube channel. The session attracted more than 100 registrations and nearly 300 online viewers and was recorded on July 23, 2020. It can be watched here.

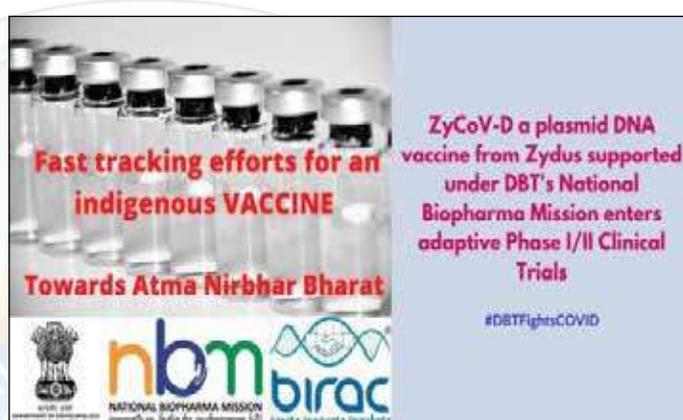
Website link:

<https://instem.res.in/>

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DBT-supported COVID-19 vaccine begins adaptive phase I/II clinical trials

Phase I/II clinical trials on a plasmid DNA vaccine designed and developed by Zydus and supported under DBT's National Biopharma Mission has been recently initiated in healthy subjects, making it the first indigenously developed vaccine for COVID-19 to be administered in humans in India.



The multi-centric adaptive Phase I/II dose escalation study will

assess the safety, tolerability, and immunogenicity of the vaccine. The human dosing of the vaccine marks a key milestone since the launching of the accelerated vaccine development programme for COVID-19 in February 2020.

Named 'ZyCoV-D', the vaccine was found to elicit a strong immune response in the pre-clinical phase in multiple animal species like mice, rats, guinea pigs and rabbits. The antibodies produced were able to neutralize the wild type virus in virus neutralization assay indicating its protective potential. No safety concerns were observed in repeat dose toxicology studies by both intramuscular and intra-dermal routes of administration. In rabbits, up to three times the intended human dose was found to be safe, well tolerated and immunogenic.

With ZyCoV-D, the DNA vaccine platform has been successfully established in the country using non-replicating and non-integrating plasmid carrying the gene of interest making it very safe. Further, with no vector response and with absence of any infectious agent, it provides ease of manufacturing with minimal biosafety requirements (BSL-I).

The platform is also known to show much improved vaccine stability and lower cold chain requirements making it easy for transportation to remote regions of the country. Furthermore, it can be rapidly used to modify the vaccine in a couple of weeks in case the virus mutates to ensure that the vaccine still elicits protection.

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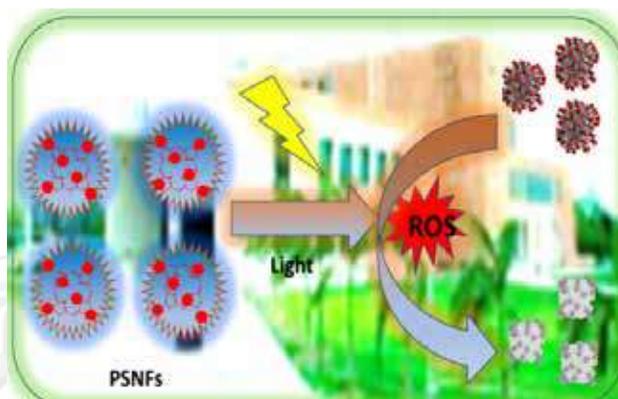
Website link:

<https://www.birac.nic.in/>

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_02S_3Aug2020.pdf

COVID-19 research preparedness initiatives at DBT-CIAB: Exploring potential of photosensitizer nanoformulations for antiviral photodynamic therapy to treat COVID-19

In order to address the ongoing pandemic, scientists at DBT's Center of Innovative and Applied Bioprocessing (CIAB) has taken multiple research initiatives and are engaged tirelessly to develop low cost, scalable and light-activatable nanomaterials in very short time-span. Photodynamic therapy (PDT) is an FDA-approved technique to treat many deadly diseases including microbial infection and cancer. The basic requirement for PDT is light, oxygen and a photosensitizer (a light-activatable fluorophore).



Antiviral PDT (aVPDT) is a branch of PDT which follows the same principles besides targeting viruses. Among photosensitizers, polypyrroles (e.g., porphyrins, chlorins - these are members of natural pigments from the heme and chlorophyll family) are commonly used which strongly absorb visible light to generate reactive oxygen species (ROS). ROS can directly damage virus targets through reacting with viral nucleic acids, lipids and proteins. Since these molecules lack aqueous solubility, preparation of their nanoformulations will improve hydrophilicity and targetability.

In this line, a group of researchers at DBT-CIAB headed by lead investigator Dr Jayeeta Bhaumik is fabricating a series of photosensitizer nanoformulations (PSNFs) in simple and scalable manner. Recently, the team has completed the synthesis and chemical characterization of the PSNFs. The materials were further examined for their photophysical properties (e.g., ROS generation capacity) showing promising potential in many of them. Further, those nanomaterials were validated for their efficacy towards antimicrobial activity against *E. coli* in the presence of low cost LEDs. The screened PSNFs with promising photophysical properties and antimicrobial activities are now ready to be sent to DBT-Regional Centre for Biotechnology BSL3 facility for testing against SARS-CoV2 cell lines. The research team has worked tirelessly during the lockdown period to prepare a series of light-activatable nanomaterials. The research team is hopeful for the library prepared by them will find a way to treat COVID-19 one day if succeeded in *in vitro* studies.

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https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_01B_3Aug2020.pdf

NCCS biobank is recognized by ICMR as a designated biorepository for COVID-19

To contribute to the ongoing national efforts against COVID-19, DBT's National Centre for Cell Science (NCCS), Pune has established a biorepository in association with the B. J. Medical College and the Armed Forces Medical College. This biobank collects and stores components



of blood called peripheral blood mononuclear cells (PBMCs) and plasma from clinical samples. Established with due approvals from the appropriate authorities, this biobank began operations in May, 2020 and has stored eighty three samples so far.

It functions in compliance with the guidelines and requirements of the Indian Council of Medical Research (ICMR), which includes obtaining informed consent from the patients or their family members prior to sample collection and following the standard operating procedures formulated for this purpose. This biobank has been recognized by the ICMR as a designated biorepository.

The NCCS Pune is one of the five institutes of the DBT to have received this recognition. A network of seventeen such biorepositories across India was established by the ICMR to provide a structured mechanism to collect and store clinical samples from COVID-19 patients in the country. Research using samples from these biorepositories would help better understand the disease in the Indian scenario. The document, 'Establishment of a network of biorepositories in India', which is available on the ICMR website (<https://www.icmr.gov.in/cbiorn.html>), provides details about this initiative undertaken for the benefit of the nation.

With the number of COVID-19 cases continuing to rise and the current pandemic showing little signs of letting up, it may continue to be a major concern for months to come. Early diagnosis and treatment are of paramount importance in the war against this disease. Research and development are also critical for public health benefits in the short and long term. Biobanks play a key role in supporting and facilitating these activities. These biological repositories collect and store different kinds of well-characterized clinical samples from patients. Such samples are crucial tools for research, which provides vital insights into the biology of the virus and the body's responses to it. They, thus, serve as a precious biological resource to develop and validate diagnostics, therapeutics and vaccines, and to design better mitigation strategies. Biorepositories are therefore a boon for public health management, especially in situations like the current pandemic.

Contact Info: Dr. Yogesh Shouche (yogesh@nccs.res.in); Dr. Punam Nagvenkar (punam@nccs.res.in); Jyoti Rao (jyoti@nccs.res.in)

Website link:

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_02B_3Aug2020.pdf

<https://www.nccs.res.in/>

Fifth Wednesday Webinar with CDSA titled “Pharmacovigilance during COVID-19 Pandemic” conducted

The CDSA-THSTI's fifth webinar in the series Wednesday Webinar with Clinical Development Service Agency (CDSA) was titled “*Pharmacovigilance during COVID-19 Pandemic*”. The first speaker Dr Y. K. Gupta, Principal Adviser (Projects) at CDSA-THSTI spoke about the problems and safety issues of drugs being used for the first time, repurposed drugs, and vaccines. The second speaker represented the Indian Pharmacopoeia Commission that has 311 ADE monitoring centres across the country. Dr Jai Prakash, Adviser at IPC gave a brief overview of the functions of the pharmacovigilance mission of India and steps taken by the Commission during the COVID-19 pandemic. The webinar was moderated by Aditya Kaushik and Vandana Chawla.

CDSA Clinical Development Services Agency **thsti**

Presents

Pharmacovigilance during Covid-19 Pandemic

WEDNESDAY WEBINAR WITH CDSA

July 22, 2020 3:00 – 4:00 PM IST

Registration: Free

Registration deadline: July 17, 2020

Registration link: https://docs.google.com/forms/d/e/1FAIpQLSc3n8p7px-rtXPh9YNkvApRdFmR_AcJl56PCJAc2Fcu81Tg/viewform?usp=sf_link

Target audience: Pharmacovigilance professionals from Govt Institutions & Industry, Clinicians, Investigators/researchers, medical and life sciences graduates

Webinar link will be provided only to the registered participants, on the day of the webinar

FACILITATORS @CDSA

Prof Usha Menon Mentor & Strategy Lead	Dr Nitya Wadhwa Faculty In charge	Dr Sucheta Banerjee Kurundkar Director Training	Ms Vandana Chawla Training Manager	Mr Jitender Ahuja Training Coordinator
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SPEAKER 1
Prof Y. K. Gupta
Principal Adviser (Project), CDSA-THSTI, DBT, President, AIIMS Jhapat and AIIMS Jammu, Former Dean & Head of Pharmacology, AIIMS, New Delhi; Member – Task Force COVID-19 in DBT, ICMR & SERB

SPEAKER 2
Dr Jaiprakash
Senior Principal Scientific Officer & Secretary-cum-Scientific Director (I/C) Indian Pharmacopoeia Commission, Ministry of Health & Family Welfare, Govt of India

“Dexathasone, Remdesivir, Itolizumab – when we have all these drugs, why not use them to treat all those who are sick?” asked my cousin who, like most of you is flooded with news on the progress science is making towards finding a drug for COVID-19. As much as we wait with bated breath for that saviour drug to act against COVID-19, scientists are also worried about are what they call *Adverse Drug Events (ADEs)*. After a drug is designed and before is shown to be safe for use and effective against a disease, it goes through a long process. No, scientists who develop the drugs don't do it themselves. A third organization undertakes activities to detect, assess, understand and thence prevent any adverse effect caused by a drug. For India, this is done by the Indian Pharmacopoeia Commission and what they do is called Pharmacovigilance. Contact Info: Dr Siuli Mitra (smitra@thsti.res.in)

Website link:

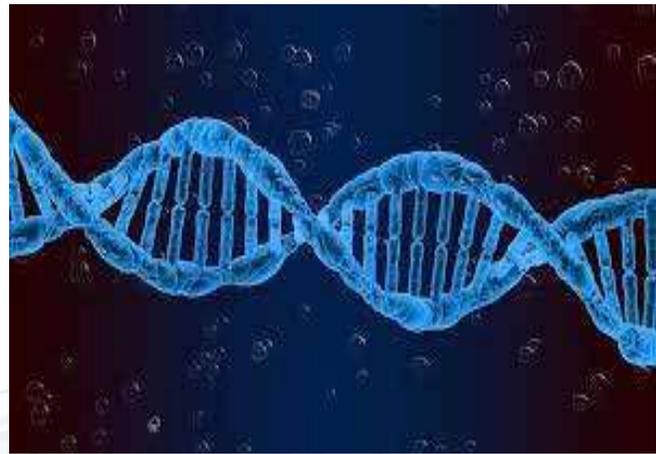
https://www.youtube.com/watch?v=uZYQ_ObeJn8&feature=youtu.be

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_03B_3Aug2020.pdf

DBT-NCCS adds 90 genome sequences of Coronavirus to global database

The National Centre for Cell Science (DBT-NCCS) in Pune, an autonomous institute of the Department of Biotechnology (DBT), has recently submitted 90 whole genome sequences of the COVID-19-causing SARS-CoV-2 virus to the global database, GISAID.

The sequences were obtained from samples of patients from Pune, Satara, and Nashik districts of Maharashtra. These sequences were compared with those reported from other domestic and global sources to identify variations. Four variations were found to be predominant. They were present in most of the sequences.



Three mutations appeared to be more frequent in samples from symptomatic patients and more prominent in samples from women. Some correlations were also observed between sequence variations and patient age, with six mutations found to be frequent in the samples from younger patients, but absent in senior patients. New and distinct patterns of mutations were observed in the viral genomes from each of the districts included in this study. These analyses thus revealed a newly emerging pattern of unique linked mutations in the genome sequences from western India, indicating that region-specific evolution of the virus genome might have occurred during the lockdown period.

The work was carried out by NCCS in collaboration with B. J. Medical College and the Armed Forces Medical College in Pune and with support from Dr. T. P. Lahane, Director, DMER, Maharashtra. The findings of this study were recently uploaded on the preprint server, bioRxiv (<https://www.biorxiv.org/content/10.1101/2020.07.30.228460v1>) for those interested in learning the details of this study.

Genome sequencing of SARS-CoV-2 was undertaken by NCCS as a participant of DBT's pan-India 1000 genome consortium set up to sequence the genomes of the virus from clinical samples collected at different locations in the country. This initiative, aimed at understanding the genetic variations in the virus across the country, is being coordinated by the National Institute of Biomedical Genomics (NIBMG) and involves several national research institutions. The consortium recently crossed the first milestone of sequencing 1000 SARS-CoV-2 genomes.

Since the outbreak of the COVID-19 pandemic and identification of the virus that causes the disease, a global rush to sequence its genome has resulted in 75,000 viral genomic sequences from across the globe being uploaded on the global GISAID database so far. This number is not surprising, since genome sequences provide valuable insights that are necessary to track and trace the outbreak, to design and evaluate diagnostic tests, and to figure out effective intervention strategies. NCCS has been contributing to the national efforts towards these goals through genome sequencing as well as other ongoing diagnostics and research initiatives.

The institute has been contributing to the ongoing COVID-19 surveillance in Maharashtra and tested over 16,000 samples in 100 days, a testimony of determined and untiring efforts of its pool of scientists and members of the technical and other staff of NCCS.

Contact Info: Dr Yogesh Shouche (yogesh@nccs.res.in), Jyoti Rao (jyoti@nccs.res.in)

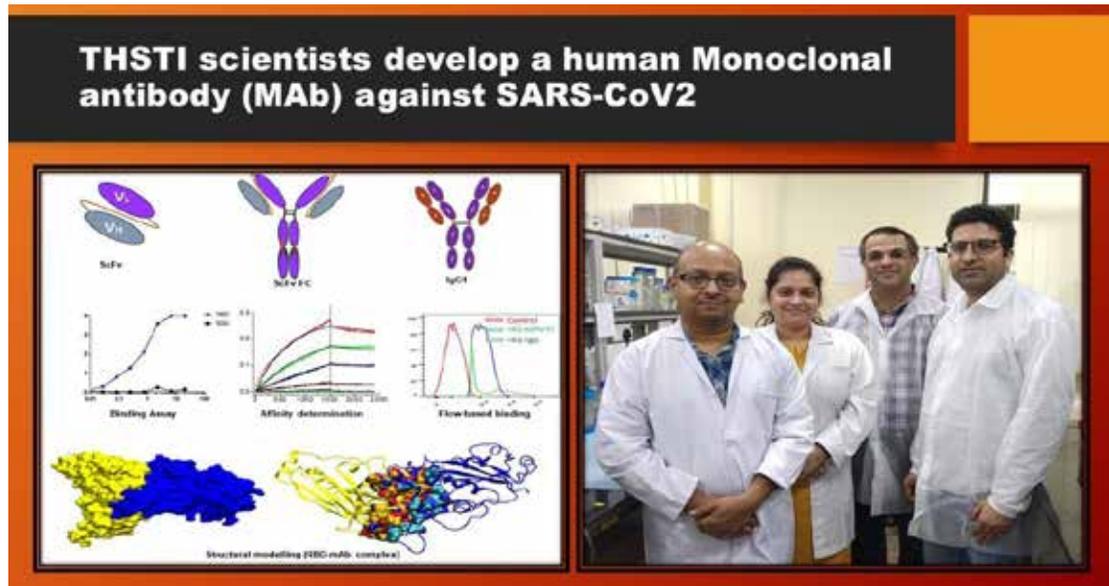
Website link:

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_03S_10Aug2020.pdf

<https://www.nccs.res.in/>

DBT-THSTI scientists take a step towards a therapy for COVID-19

A team of scientists from the Infection and Immunity Programme of the DBT's Translational Health Science and Technology Institute (DBT-THSTI), led by Dr Rajesh Kumar, has developed a human monoclonal antibody (mAb) against the receptor-binding domain (RBD) of SARS-CoV-2. The monoclonal antibody has been shown to bind to the RBD protein of SARS-CoV-2 with high affinity and specificity. The RBD of the spike protein of SARS-CoV-2 is the primary target for neutralizing antibodies to block infection.



The team hopes the new development will facilitate COVID-19 research activities across the country. It has developed different formats of this mAb - scFv, scFv-Fc, and IgG1 against COVID-19. This well-established platform will allow isolating and neutralizing antibodies against COVID-19, which might be helpful as an alternate therapeutic.

Further, the availability of an extensive array of SARS-CoV-2-specific monoclonal antibodies can help design vaccines through structural vaccinology. This part of the research work has been submitted to a peer-reviewed journal for consideration.

The other co-investigators in the project are Drs Shubbir Ahmad, Sweetey Samal, Tripti Shrivastava, Hilal Ahmad, Shailendra Asthana, Chandresh Sharma, Shailendra Mani, and Adrash Chiranjivi. The research is funded by the DBT.

Contact Info: Dr Siuli Mitra (smitra@thsti.res.in)

Website link:

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_02S_10Aug2020.pdf

<https://thsti.res.in/>

Genomics to develop plant-based therapies for SARS-CoV-2

COVID-19 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is devastating to mankind for which neither vaccines nor precise molecules for treatment are identified yet. The search for new drugs and repurposing of existing drugs is on. Alongside, research on plants to identify novel therapeutic compounds besides testing the existing ones

is also progressing. Genomics and biotechnology offer various tools and strategies to manipulate plants for producing those complex biopharmaceutical products.



A review article prepared by a group of scientists at the DBT's National Institute of Plant Genome Research (DBT-NIPGR) and Department of Plant Sciences at the School of Life Sciences in University of Hyderabad and published in Science Direct, enumerates the scope for research on plant-based molecules for their potential application in treating SARS-CoV-2 infection.

Strategies to edit gene and genome, over-expression and silencing approaches and molecular breeding for producing target biomolecules in the plant system are discussed in detail. Altogether, the review provides a roadmap for expediting research on using plants as a novel source of active biomolecules having therapeutic applications.

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Website link:

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_01S_10Aug2020.pdf

<http://www.nipgr.ac.in/home/home.php>

<https://www.sciencedirect.com/science/article/pii/S0888754320308958?dgcid=author>

Natural garlic essential oil: A potential inhibitor of ACE 2 protein and the main protease PDB6LU7 of SARS-CoV-2

In an investigation at DBT's Center of Innovative and Applied Bioprocessing (DBT-CIAB), garlic essential oil was found to contain allyl disulfide, allyl trisulfide, allyl tetrasulfide, allyl methyl trisulfide, and allyl propenyl disulfide as major constituents, while 2-vinyl-1,3-dithiine, carvone and 1, 2-dithiole as minor constituents. Having detected successfully the volatiles occurring in the garlic essential oil, its further *in vitro* and *in vivo* antiviral assays against the ACE2 protein and the main protease PDB6LU7 of SARS-CoV-2 will be investigated by Regional Centre for Biotechnology (RCB) and Translational Health Science and Technology Institute (THSTI), Faridabad.



The outbreak of COVID-19 caused by SARS-CoV-2 infection in Wuhan, China, has posed a serious threat to global public health. The World Health Organization (WHO) has designated the ongoing pandemic of novel COVID-19 as a 'Public Health Emergency of International Concern'. Therefore, development of natural and safe medicines to prevent coronavirus is of great interest for all scientists around the world.

With abundant medicinal resources in India and the specific medicinal properties of garlic, the scientists at DBT-CIAB undertook the work of qualitative compositional analysis of garlic (*Allium sativum* L.) essential oil followed by evaluation of its biological activity against angiotensin-converting enzyme 2 (ACE2), an integral membrane glycoprotein that is known for the highest expression in most tissues such as kidneys, endothelium, lungs, and heart.

Contact Info: Dr Bhuwan Bhushan Mishra (bhuwan@ciab.res.in)

Website link:

<https://pesquisa.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/en/covidwho-20895>

<http://www.ciab.res.in/>

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_02B_7Aug2020.pdf

ICGEB featured as South-South Galaxy partner of the Month

DBT's International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi has been featured as the partner of the Month (July 2020) by the South-South Galaxy team as recognition of its remarkable work in the field of South-South cooperation. South-South Galaxy is a global knowledge sharing and partnership brokering platform, supported by the United Nations Office for South-South Cooperation (UNOSSC).

Currently, ICGEB counts 65 member states with the majority of member states being countries of the Global South. Efforts of ICGEB for implementing South-South cooperation in all of its actions - promoting scientific cooperation, capacity building, and technology transfer were



greatly appreciated. The ICGEB acknowledged the offer as a modern model for cooperative action, including knowledge exchange and peer learning for human capital development in support of the local Governments.

In the present moment of global crisis when the need for South-South and triangular scientific cooperation is greatly desired, efforts of ICGEB are well recognized. ICGEB has responded with efforts to directly provide rapid assistance to its constituency with diagnostics, surveillance, and capacity enhancement for handling the COVID-19 crisis, bringing critical information and technologies to where they are most needed.

The detailed information on ICGEB's resources, tools, and know-how to fight the SARS-CoV-2 virus is made easily available on the link <https://www.icgeb.org/covid19-resources/> to its member states.

Contact Info: Ms. Suzanne Kerbavcic (kerbav@icgeb.org); Dr. Nidhi Datta (nidhicgeb@gmail.com)

Website link:

<https://www.icgeb.org/icgeb-south-south-cooperation-partner-of-the-month/>

<https://www.icgeb.org/>

https://vigyanprasar.gov.in/wp-content/uploads/vigyan_samachar_dbt_01BB_10Aug2020.pdf

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

Launch of compendium on CSIR technologies for COVID-19 mitigation

CSIR and its constituent laboratories have been working continuously to fight COVID-19 and have introduced a number of technical solutions against the pandemic. Now a compendium of such technologies prepared by the CSIR has been launched by Hon'ble Minister for S&T, Health & family welfare and MoES Dr Harsh Vardhan recently in New Delhi.

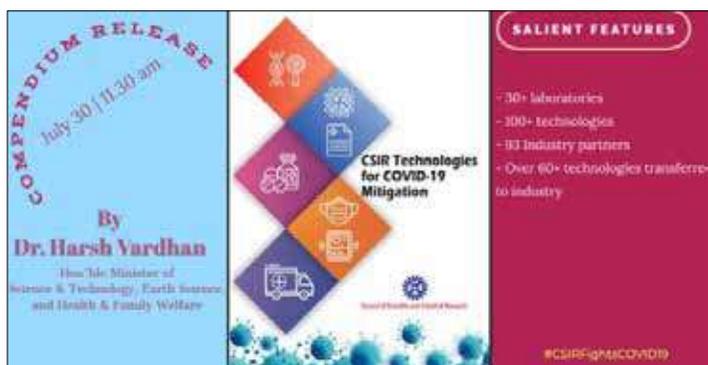


The compendium covers a wide range of technologies and products spanning from diagnostics to drugs to ventilators and PPEs with more than 100 technologies, 93 industry partners listed and with over 60 of these technologies have been transferred to industry.

Dr Harsh Vardhan observed that “The portfolio of technologies and products developed in a short time are a testament to the capabilities of CSIR scientists and that they can deliver in most difficult of the circumstances.” He complimented the efforts of the scientists, students and staff of CSIR for developing these technologies and products at such short notice in these challenging conditions. He said that “The compendium brought out by CSIR captures the technologies and products well in one place and can help industries and other agencies who are seeking solutions for Covid-19 to access them easily.”

Expressing his satisfaction, the Minister said, “CSIR has made significant contributions to India’s fight against COVID-19 on various fronts ranging from augmenting testing capacity to

developing novel diagnostics and making affordable repurposed drugs available to patients in partnership with industry”. “Further, CSIR has developed many hospital assistive devices such as ventilators and PPEs for which a shortage was felt early on in the pandemic,” he said and added that “Now CSIR has compiled a compendium which captures the technologies, products and know-how developed for mitigation of Covid-19 pandemic.”



Dr Harsh Vardhan also complimented the role of CSIR in bringing repurposed drugs against COVID-19 to patients at the earliest in partnership with industry such as Cipla for Favipiravir. He emphasized that efforts such as these will benefit COVID-19 patients by making the drugs affordable. “CSIR-IICT has developed a cost-effective synthetic process technology for Active Pharmaceutical Ingredient (API) of Favipiravir using locally available chemicals and transferred the technology to Cipla who scaled up and manufactured the drug based on this technology,” he said.

The Minister also highlighted the contribution of CSIR-NAL, whose expertise though is in aviation, rose to the challenge and developed Swasth Vayu a non-invasive BiPAP ventilator in a short span of 36 days. Dr Harsh Vardhan exhorted the scientific community to come together and develop new innovations, technologies and products at this time of need as it is only S&T that can drive us out of this pandemic and also fulfil the aspirations of ‘Aatma Nirbhar Bharat’. He also noted that CSIR has developed Kisan Sabha, a one-stop solution to connect farmers to supply chain and freight transportation management system, has been developed and more than 60,000 downloads have been reported so far. It is available in many regional languages and also connects farmers directly to Mandis.



DG CSIR, Dr Shekhar C Mande said that CSIR has partnered with not only large industries such as TATA Sons, Reliance Industries etc. but also with PSUs such as BHEL and BEL and MSMEs for the deployment of the technologies and products at the earliest. Further, he highlighted that CSIR has developed a COVID-19 Portal that captures these technologies in an easily searchable format for users.

Website Link:

<https://pib.gov.in/PressReleasePage.aspx?PRID=1642423>

DBT & CSIR has sequenced more than 1000 SARS-CoV-2 viral genomes: Dr Harsh Vardhan

Minister of Science & Technology, Earth Sciences and Health & Family Welfare, Dr Harsh Vardhan has announced that Indian scientists from DBT and CSIR have sequenced more than 1000 SARS-CoV-2 viral genomes making it the largest effort in the country. "This will help in understanding the prevalent strains and the mutation spectrum in India, which will help in diagnostics, drugs and vaccines," he said.

Dr Harsh Vardhan was speaking while releasing a compendium of COVID-19 technologies and products developed by CSIR, at a function in New Delhi on 30th July. The function was attended by Joint Secretary, CSIR, Shri K.R.Vaideeshwaran; Financial Advisor, CSIR, Ms Sumita Sarkar; Head, HRDG & RAB, Shri A. Chakraborty; Head, CSIR's Central Planning Division, Shri Venkatasubramnian; Head, CSIR's Innovation Management Directorate, Shri R. P. Singh; Head, CSIR's Science Communication and Dissemination Directorate, Dr. Geetha Vani Rayasam; and Senior Principal Scientist, Shri G. Mahesh while other senior officials and scientists of CSIR from various parts of the country joined the online event.

Website Link:

<https://pib.gov.in/PressReleasePage.aspx?PRID=1642423>

India-Israel joint cooperation starts trial for rapid testing

In joint cooperation between Israel and India, rapid tests for identifying COVID-19 are being developed which will provide results in less than 30 seconds if successful.

Trials started in the last week of July at a special testing site at Dr Ram Manohar Lohia (RML) Hospital. It has been developed jointly in cooperation with Ministry of Defence Israel and Defence Research and Development Organisation (DRDO), Council of Scientific and Industrial Research (CSIR) and Principal Scientific Adviser (PSA), India and coordinated by the Ministry of Foreign Affairs Israel and India.

While speaking with ANI, Ron Malka, Ambassador of Israel to India said, "With the outbreak of the pandemic, our two Prime Ministers had some conversations and decided to incorporate into joint research and find a solution for COVID-19. This scientific cooperation will give results within a few seconds, and if successful this research will be a revolution."

"Other than a cooperating and joint venture, other initiatives are also there such as agriculture water science technology. Just two weeks ago, we signed an MoU in cybersecurity," Malka added.

"When this pandemic broke out India helped Israel to evacuate thousands of Israelis stranded all over. India supplied Israel medicines, the raw material for medicine and whatever was needed. This is how good friendship is," added Malka.



K. Vijay Raghavan, Principal Scientific Advisor from the Prime Minister of India's office (PMO) told, "Science and technology have come to public level as it should. The speed with which science and technology have come for public health is amazing. The collaboration between Israel and India is stunning."

Raghavan, in addition, stated, "Israel and India share collaborations in every area of science. The friendship and trust our countries have developed over the years have improved the ongoing studies' speed and quality. I am sure that some of these will be successful and result in great value to our countries and humanity."

These trials are a part of a multi-pronged mission visiting India from Israel to cooperate on COVID-19 research and development, further cementing the strategic relationship between the two nations. Results are expected to be available within two weeks.

Website Link:

<https://www.csir.res.in/slider/collaborative-trials-drdo-india-drron-malka-and-csir-ind-test-four-rapid-testing-technologies>

<https://www.newindianexpress.com/nation/2020/jul/31/india-israel-joint-cooperation-starts-trial-for-rapid-testing-result-in-less-than-30-secs-if-succes-2177405.html>

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

INDIAN COUNCIL OF MEDICAL RESEARCH (ICMR) AND MINISTRY OF HEALTH & FAMILY WELFARE (MOHFW)

ICMR invites Expression of Interest for validation of rapid antigen detection assays for COVID-19

ICMR invites applications for validation of rapid antigen detection tests for COVID-19 from all manufacturers who have developed rapid antigen-based detection assays for Coronavirus wherein all manufacturers who have developed antigen-based assays have been invited for validation. The gold standard RT-PCR diagnostic test for COVID-19 has limitations in terms of widespread availability. In view of this, there is urgent requirement of reliable and convenient rapid point-of-care antigen detection assays with high sensitivity and specificity. Such assays could be used as potential diagnostic tests in all possible public and private healthcare settings and made available for mass testing.

Contact Info: guptanivedita.hq@icmr.gov.in

Website Link:

https://www.icmr.gov.in/pdf/tender/Revised_EOI_for_Ag_kit_validation.pdf

<https://www.icmr.gov.in/tender.html>

ICMR invites letter of intent for participation in National Clinical Registry for COVID-19

There is a pressing need for collection of systematic data on clinical signs and symptoms, laboratory investigations, management protocols, clinical course of COVID-19 disease, disease spectrum and outcomes of patients. Such data will serve as an invaluable tool for formulating appropriate patient management strategies, predicting disease severity, patient outcomes etc. In view of this, Ministry of Health & Family Welfare (MoHFW), ICMR, New Delhi and All India Institute of Medical Sciences (AIIMS), New Delhi have proposed to launch a National Clinical Registry for COVID-19 (NCRC). The NCRC will aim at collecting good quality real-time clinical data to inform evidence-based clinical practice, research, formulating guidelines and policy making.

In view of this, Indian Council of Medical Research (ICMR) invites a letter of intent from institutions and hospitals identified as dedicated COVID Hospitals or dedicated COVID Health Centres under the project to establish 'National Clinical Registry of COVID-19.

Website Link:

<https://www.mohfw.gov.in/pdf/Guidelinesonyogainstitutesandgymnasiums03082020.pdf>

<https://www.icmr.gov.in/tender.html>

MoHFW releases guidelines on preventive measures to contain spread of COVID-19 in Yoga Institutes & Gymsnasiums

To contain the spread of COVID-19 infection, lockdown was imposed, which is now being gradually relaxed in a phased manner. Yoga and physical activity being important for health and well-being, it has been decided to open yoga institutes and gymnasiums from 5th August, 2020. Yoga Institutes and Gymnasiums shall adhere to protocols and prevention measures outlined in the guidelines issued by Ministry of Health & Family Welfare (MoHFW) to prevent the spread of COVID-19.

This document outlines various generic precautionary measures to be adopted in addition to specific measures to be taken at yoga institutes and gymnasiums to prevent spread of COVID-19. The guidelines aim to minimize all possible physical contacts between staff, members and visitors and maintain social distancing and other preventive and safety measures in context of COVID-19.



Website Link:

<https://www.mohfw.gov.in/pdf/Guidelinesonyogainstitutesandgymnasiums03082020.pdf>

Invitation for submitting Letter of Intent for Participation in National Clinical Registry of COVID-19

There is a pressing need for collection of systematic data on clinical signs and symptoms, laboratory investigations, management protocols, clinical course of COVID-19 disease, disease spectrum and outcomes of patients. Such data will serve as an invaluable tool for formulating appropriate patient management strategies, predicting disease severity, patient outcomes etc. In view of this, Ministry of Health & Family Welfare (MoH&FW), Indian Council of Medical Research (ICMR), New Delhi and All India Institute of Medical Sciences (AIIMS), New Delhi have proposed to launch a National Clinical Registry for COVID-19 (NCRC). The Registry will aim at collecting good quality real-time clinical data to inform evidence-based clinical practice, research, formulating guidelines and policy making.

In view of this, ICMR invites a letter of intent from institutions/hospitals identified as dedicated COVID Hospitals or dedicated COVID Health Centres under the project to establish “National Clinical Registry of COVID-19”. Primary objectives of the project are as follows –

1. To develop a National Clinical COVID-19 registry to collect data regarding clinical and laboratory features, treatments, and outcomes of hospitalized COVID-19 patients in India.
2. To study the frequency, clinical and laboratory features, treatments, and outcomes of COVID-19-related multisystem inflammatory disorder in children and adolescents by analyzing the national COVID-19 registry.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/Letter_of_Intent_National_Clinical_Regisrty_of_COVID19_v1.pdf

Evidence-based Advisory on Correlation of COVID-19 Disease Severity with Cycle Threshold Values of the Real-Time RT-PCR Test

Real-Time Reverse Transcription Polymerase Chain Reaction (Real-Time RT-PCR) is the gold standard test for detection of SARS-CoV-2. This test enables early detection of viral genome in clinical samples. A positive test enables the clinicians and public health professionals to quickly isolate the patient and prevent spread of the disease. The cycle threshold or Ct value of a RT-PCR reaction is the number of cycles at which fluorescence of the PCR product is detectable over and above the background signal. Theoretically, the Ct value is inversely proportional to the amount of genetic material (RNA) in the starting sample and lower Ct values generally correlate with high viral load. It is being assumed by some researchers/clinicians that high viral load directly correlates with increased infectiousness and severity of disease. However, the evidence is not robust enough to definitively support this assumption. Recent discussions about guiding the clinical decision-making process based on the Ct values of RT-PCR test reported by laboratories have several limitations. ICMR has discussed the issue of correlating COVID-19 disease severity with Ct values and accordingly deciding on patient management protocol, with a panel of esteemed laboratory experts and also provide consolidated recommendations.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/Advisory_on_correlation_of_COVID_severity_with_Ct_values.pdf

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

DEFENCE RESEARCH AND DEVELOPMENT ORGANISATION (DRDO)

DRDO develops TAARAN for safe patients transfer system to combat COVID-19

A unique system is developed to transfer infected patients while protecting healthcare workers and general public from air-borne/droplet infections such as COVID-19. It is a Stainless Steel wheel chair-based design for transfer of patients not requiring stretchered evacuation. It has high capacity HEPA filters maintained at negative pressure to collect 99.99% of infectious droplets. The air flow is maintained such that every breath of the patient is sucked out. The aerosol containing viruses, bacterial/microbial pathogens are drawn into filtration assembly where micro-droplets are filtered while pathogens are neutralized by continuous UV-C exposure. The cleaned exhaust air is re-circulated back into the environment or can be directly used by patients with “re-succinating masks”.



Suspected/partially confirmed/confirmed patient can be rolled out to any location using this portable and mobile unit. It can be easily operated by single attendant. The system is useful for OPD clinics, acute care, in-patient areas, emergency rooms and portable field/makeshift hospitals dedicated for COVID-19 management. The system is extremely beneficial as provisioning of quality healthcare.

Website link:

<https://www.drdo.gov.in/hospital-aids>

SCIENCE & TECHNOLOGY EFFORTS ON COVID-19

BY

SCIENTIFIC AND ACADEMIC INSTITUTIONS

IISc develops open-source aerosol shield for intubation and anaesthesia

The virus causing COVID-19 can be transmitted through droplets of different size (less than 10 micrometres) which get airborne in the vicinity of an infected patient. The medical team which comes in proximity needs to be protected from this undesirable exposure to the virus.

During a crisis, when shortage of personal protective equipment is expected, alternative solutions will be needed to protect the medical team. While placing a patient on a ventilator or anaesthesia, a tube is inserted into the patients' airways through his/her mouth. This exposes the medical team to the air exhaled by the patient, which might carry aerosolized infectious virus. In order to prevent this situation, a transparent aerosol box is designed by the Indian Institute of Science (IISc) to prevent from contaminations generated by COVID-19 positive patients.

Contact Info: Manish Arora; marora@iisc.ac.in



Website Link:

<https://covid19.iisc.ac.in/opensource-aerosol-shield-for-intubation-and-anaesthesia/#:~:text=Open%20source%20aerosol%20shield%20for%20intubation%20and%20anaesthesia,Team%20Lead%3A%20Manish&text=While%20placing%20a%20patient%20on,might%20carry%20aerosolized%20infectious%20virus>

IISc develops cyclone separator design for compressor exit flow oil and dust particle cleanup

The onset of the novel coronavirus (COVID-19) pandemic has resulted in an unprecedented and rapid increase in demands on public health systems worldwide. Thus, it has become necessary to improve access to key medical equipment such as ventilators in order to offset reduced lung function in symptomatic COVID-19 patients.

Indian Institute of Science (IISc) designed a cyclone-based system for compressor exit flow oil and dust particle cleanup. The aim of this effort is to develop a cyclone-based oil droplet separator system as part of the ongoing IISc ventilator development effort, which can be used

to reduce the oil droplet and dust particle load on standard filters, thereby prolonging their life and reducing the requirement for frequent maintenance intervals. The device will work by spinning the droplet and dust-laden air in a tube, causing the suspended matter to move outwards towards the wall, while leaving the air in the core of the tube free of suspended matter. This clean air can then be passed through a final filtration step to render the air quality consistent with medical requirements.

Contact Info: Santosh Hemachandra; hsantosh@iisc.ac.in

Website Link:

<https://covid19.iisc.ac.in/cyclone-separator-design-for-compressor-exit-flow-oil-and-dust-particle-cleanup/>

IISc designs framework for testing strategies for COVID-19

The number of confirmed cases of COVID-19 is often used as a proxy for the actual number of COVID-19 infected cases in both public discourse and policy making. However, the number of confirmed cases depends on the testing policy, and it is important to understand how the number of positive cases obtained using different testing policies reveals the unknown ground truth. Indian Institute of Science (IISc) develops an agent-based simulation framework to evaluate and compare various testing policies, such as random symptomatic testing, contact tracing and spatially aware sampling of hotspots, as well as interventions such as lockdowns based on their output. This framework will be useful in designing and evaluating testing strategies for both inference and intervention purposes.

Contact Info: aditya@iisc.ac.in, htyagi@iisc.ac.in

Website Link:

<https://covid19.iisc.ac.in/framework-for-studying-testing-strategies-for-covid-19/>

IISc developing reliable COVID-19 infection rate estimator

Indian Institute of Science (IISc) is in the process of developing a reliable means of estimating the prevalence rate or infection of the novel coronavirus (SARS-CoV-2) within a target population. This can be used as an epidemiological or public health tool to help inform policy decisions on the appropriate interventions to impose on that population. At present, this estimator takes as input the time series formed by the number of hospitalized cases that test positive each day. The website hosting the estimator contains a basic description of the estimator. A report explaining how the estimator works is currently in preparation.

Contact Info: nkashyap@iisc.ac.in, manju@iisc.ac.in

Website Link:

<https://covid19.iisc.ac.in/covid-19-infection-rate-estimation/>

IIT Kanpur develops HITES, a handheld Infrared thermometer, which can be used maintaining 6 ft distance

Indian Institute of Technology Kanpur (IITK) develops a device called HITES, a handheld infrared thermometer with enhanced safety. The device is developed at National Centre for Flexible Electronics (NCFlexE) at IIT Kanpur. It enables temperature scanning to be carried out while maintaining a 6-foot physical distance.

Contact Info: flexe@iitk.ac.in

Website Link:

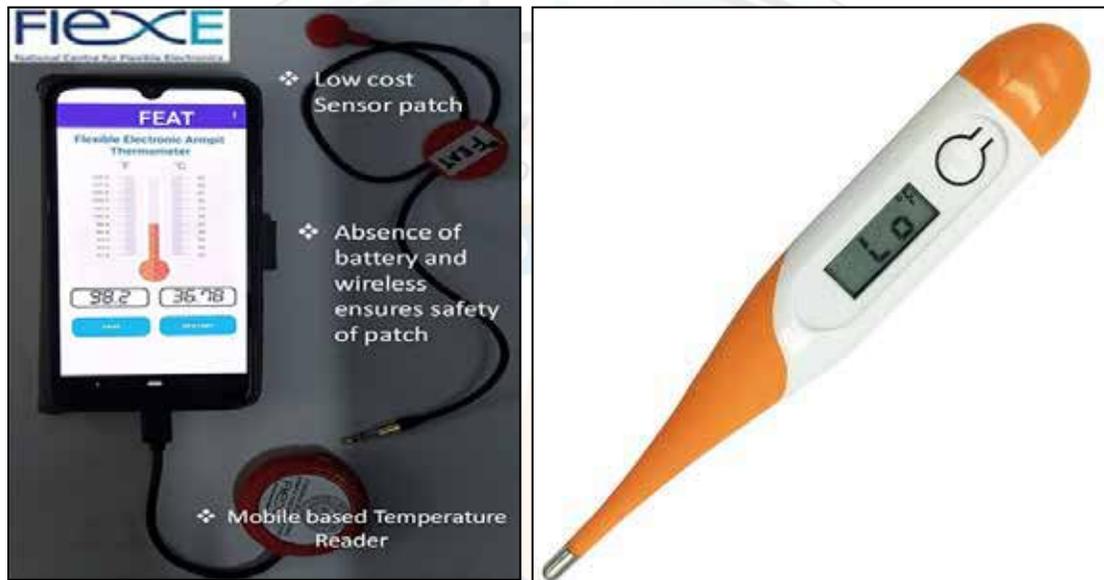
<https://www.iitk.ac.in/new/hites-a-handheld-infrared-thermometer>



IIT Kanpur develops flexible electronic armpit thermometer

National Centre for Flexible Electronics (NCFlexE) at IIT Kanpur has developed a Flexible Electric Axillary (Armpit) Thermometer (FEAT) that enables monitoring of temperature in patients in an easy and hygienic manner even in an unconscious patient.

FEAT provides a digital record on the mobile or over the cloud and never runs out of battery. In contrast to conventional thermometers, FEAT consists of two separate parts; a flexible patch worn by the patient and a cell phone-based electronic reader. The patch is safe to wear over extended periods as it does not contain either a battery or a wireless source. The patch is low cost and can be either disposed or retained for reuse by the patient afterwards. The mobile-based temperature reader provides the temperature reading instantaneously and records it, if required upon contact with the patch, and can be used with multiple patients.



Contact Info: flexe@iitk.ac.in

Website Link:

<http://www.ncflexe.in/flexible-electronic-axillary-thermometer.php>

IIT Tirupati developed Novel Thermal Air Sterilizer – BLAAST

Indian Institute of Technology (IIT), Tirupati has developed a machine to sterilise the air in a room within a few hours thereby help in combating the coronavirus which initially attacks the respiratory system. The institute has worked with industry partner, Outstazs Hospitality Solutions, a start-up based in Bengaluru and Thiruvanthapuram to develop the device while the efficacy has been proved with the help of microbiological tests at IISER Tirupati.

The device can capture the surrounding air and give out sterile air by using the principal of suction-heating-recycling-purging of air. Named as BLAAST (Blower-aided air Sterilisation by Temperature), it



can be operated within a targeted suction of a coronavirus carrier's exhalations (droplets, micro droplets and aerosols) from a close proximity and immediately deactivating the virus continuously by high temperature ranging between 55 to 60 degree Celsius and thereby control the spread of the contagious disease.

Website Link:

https://iitp.ac.in/pics/News_clip_BLAASST_Prototype.jpg

IISER Pune signs technology transfer MoU for low-cost ventilator

The low-cost ICU ventilator developed earlier at the Physics department of IISER Pune will now be jointly taken up by Accurate Gauging & Instruments Pvt. Ltd. and IISER Pune to be built for regulatory approvals followed by production.

Towards this, a Memorandum of Understanding for transfer of technology was signed by IISER Pune and Accurate Gauging & Instruments Pvt. Ltd. on August 4, 2020. Under the terms of this agreement, the industrial partner would now build mass-producible prototypes of the ICU ventilator developed at IISER Pune for regulatory approvals.



Website Link:

<http://www.iiserpune.ac.in/news/technology-transfer-mou-for-low>

SCIENCE OUTREACH & POPULARISATION EFFORTS

Since the outbreak of COVID-19 pandemic, the Ministry has supported numerous research projects and technology interventions through its various Departments, Autonomous Organisations, Professional Bodies, Statutory Bodies, and Laboratories. In the expedition of science outreach and popularisation, a number of knowledge and information products have been generated and released.

Efforts from Ministries, Departments & Scientific Organisations

CSIR-Samachar July 2020 edition enumerates CSIR initiatives to combat COVID-19

CSIR-Samachar is a monthly Newsletter published by National Institute of Science Communication and Information resources (CSIR-NISCAIR). The newsletter consists of various contemporary activities, currently related to COVID-19 and reports of the CSIR, such as R&D programmes, achievements, new facilities, foundation day celebration, symposia, conferences, seminars, workshops, lectures, exhibitions, demonstrations, training programmes, honours & awards, visits and appointments. A cover story related to Drug Discovery Hackathon 2020 has been published in the edition.



Contact Info: Dr Manish Mohan Gore, mmg@niscair.res.in

Website Link:

<https://www.niscair.res.in/includes/images/csirsamachar/csir-samachar-july20.pdf>

Drug Discovery Hackathon 2020 launched for drug discovery against COVID-19

Drug Discovery Hackathon 2020 (DDH2020) platform welcomes all those who wish to join the open-source drug discovery Hackathon against COVID-19. DDH2020 is a joint initiative of All India Council for Technical Education (AICTE) and Council of Scientific and Industrial Research (CSIR) and supported by Office of the Principal Scientific Adviser (PSA), Government of India, National Informatics Centre (NIC) and MyGov India.

The vision and mission of DDH2020 vision and mission is to establish 'Open innovation Model' for *in silico* drug discovery against COVID-19 virus and will cover the various processes in drug discovery, including but not limited to, *in silico* screening of molecules, lead optimization and identification of drug-able non-toxic targets. The targets/tools/lead molecules identified through the process of DDH2020 will be further taken forward for synthesis followed by subsequent steps in routine drug discovery programme.

Objective of the Hackathon is to identify drug candidates that are effective against coronavirus SARS-CoV-2 by employing a hackathon for *in-silico* drug discovery, followed up by chemical synthesis and biological testing.

The Hackathon consists of two major tracks:

Track-1 will primarily deal with drug design for anti-COVID-19 hit/lead molecule generation using tools such as molecular modelling, pharmacophore optimization, molecular docking, hit/lead optimization, etc.

Track-2 will deal with designing/optimizing new tools and algorithms which will have an immense impact on expediting the process of *in silico* drug discovery. Novel or refined tools/algorithms from Track-2 will help develop better models for predicting ADMET *in silico*, thus improving screening efficiency.



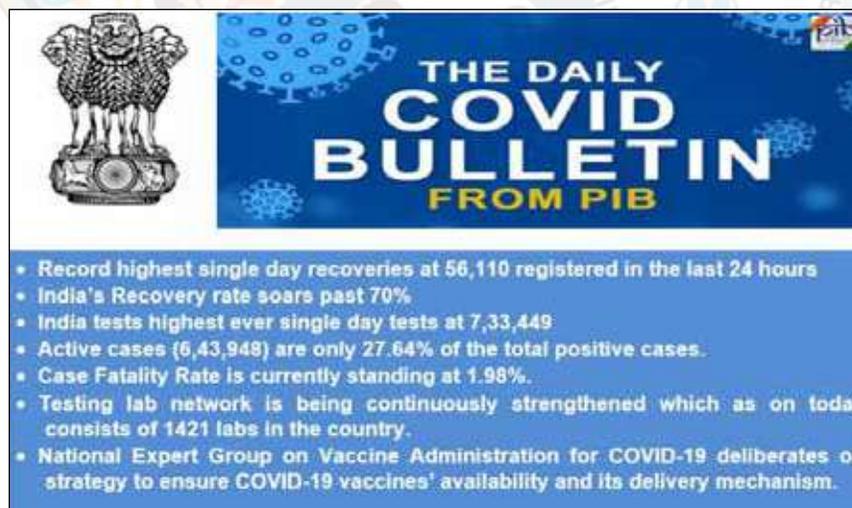
Last date of submission for Phase-I: 30th September 2020

Website link:

<https://innovateindia.mygov.in/ddh2020/>

Press Information Bureau releases daily bulletin on COVID-19

Press Information Bureau (PIB), Government of India releases a daily bulletin on COVID-19. The bulletin contains press releases concerning COVID-19, issued in last 24 hours, inputs from PIB field offices and fact checks undertaken by PIB.



Website Link:

<https://pib.gov.in/PressReleasePage.aspx?PRID=1645384>

Government of India presents regular COVID-19 India factsheet

India's coronavirus cases have crossed 20-lakhs mark and as on 10th August 2020, 8:00 AM, stands at 22,15,074 cases out of which 15,35,743 have recovered. The recovery rate stands at 69%. Government of India, through its Open Government Data (OGD) Platform <https://data.gov.in/> has taken the initiative to present the regular factsheet related to COVID-19.

The OGD platform is aimed at supporting Open Data initiative of Government of India. The portal

is used by various Ministries, Departments, and their organizations, to publish datasets, documents, services, tools and applications collected by them for public use. It intends to increase transparency in the functioning of Government and also opens avenues for many more innovative uses of Government Data to give different perspective.

Website Link:

<https://community.data.gov.in/covid-19-india-factsheet-as-on-07th-aug-2020-800-am/>



COVID-19 Management Portal developed by National Informatics Centre for management of quarantined people by Delhi Government

National Informatics Centre (NIC) has developed the 'COVID-19 Management Portal' for management of quarantined persons at quarantine centres by the Government of Delhi. This portal provides features like database of quarantined person, unique case ID, search based on case ID etc. In addition, the portal has home isolation protocol, details of relief funds provided by Government of Delhi, and a Whatsapp helpline number for the users. Home isolation protocol also provides guidelines for caregivers, attendants, and neighbours of COVID-19 patients.

Website link:

<https://coviddelhi.nic.in/>

DRDO Newsletter enlists initiatives by its laboratories extending help in fight against COVID-19

Defence Research and Development Organisation (DRDO) is the apex body of research associated with defence technologies in India. It publishes a monthly newsletter to speak regularly with its stakeholders, subscribers and audience, covering the happenings within the organisation in last one month. It is in its 40th year of publication.

DRDO has been in forefront of fight against COVID-19 since its detection in India. The premier R&D organisation has innovated and configured many products required



immediately to regulate the pandemic from its existing arsenal of technologies and knowledge. These ingenious efforts have led to the event of the many mitigation solutions, which are passed on to the industry for production. A number of products developed by the DRDO to reinforce operations and to regulate spread of the infection are covered in the newsletter. While DRDO labs are engaged in providing technological solutions and have developed variety of mitigation products, many of its labs are engaged in providing help to local administration in combat against COVID-19.

Contact Info: director@desidoc.drdo.in

Website link:

https://drdo.gov.in/sites/default/files/whats_new_document/NL_August2020.pdf

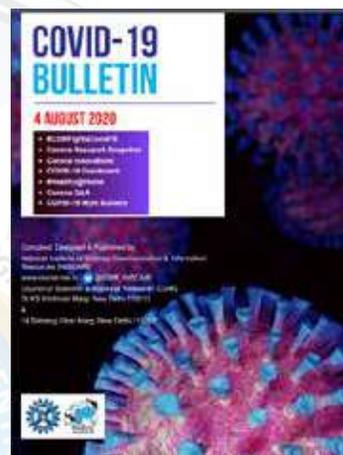
CSIR-NISCAIR brings out weekly e-Newsletter on COVID-19

National Institute of Science Communication and Information Resources (CSIR-NISCAIR) is bringing out a newsletter dedicated for the COVID-19 outbreak. The newsletter covers stories and information on various aspects, like research, technology and innovation efforts to fight the pandemic out and related awareness and sensitisation information. The latest edition dated 4th August 2020 has been published.

Website Link:

<https://www.niscair.res.in/covidbulletin/view/13>

<https://www.niscair.res.in/covidbulletin>



Efforts from Vigyan Prasar

India Science Channel

India Science is an Internet-based Over-The-Top (OTT) Science TV channel. It is an initiative of the Department of Science and Technology (DST), Government of India, implemented and managed by Vigyan Prasar (VP), an autonomous organisation of the Department of Science and Technology. 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 the 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, the advantages of science and technology must reach all sections of 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.

Weekly COVID video bulletin: Produced in both Hindi and English language weekly basis from 7 July 2020, COVID bulletin apprises the audience about the latest development happening in S&T in India that are helping in managing and overcoming the challenges thrown up by the pandemic. Vigyan Prasar was produced daily COVID Bulletin during 11 April to 06 July 2020.

COVID Explained - Short films to explain important research finding related to COVID-19 in layman's lingo produced weekly basis. The subjects chosen for this short film caters to the curiosity of common man related to COVID-19

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

Masking up with Women Entrepreneurship Platform: NITI Aayog's flagship initiative

Empowers women home-based workers from grassroots & not-for-profit organisations as well as small businesses

Facilitates connections with potential buyers for sale and funding support

Facilitates connections to raw material suppliers



@ISTIPortal

@ISTIPortal

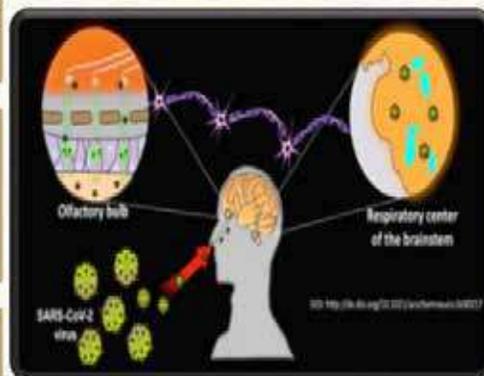
<http://www.indiascienceandtechnology.gov.in/>

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

Researchers at CSIR-Indian Institute of Chemical Biology (IICB), Kolkata has explored the neuro-invasive potential of SARS-CoV-2.

Research highlight that SARS-CoV-2 virus might enter the human brain through the nose and reaches the olfactory bulb of the brain which infect PreBötzing complex (PBC), the primary centre of the brain that controls the respiratory rhythm generation.

Postmortem of brain of COVID-19 patients could be assessed to know the route of entry and affected areas including detailed assessment of respiratory center of the brain.



@ISTIPortal

<http://www.indiascienceandtechnology.gov.in/>

@ISTIPortal

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. The ISTI web portal has been developed by VigyanPrasar, an autonomous organisation of the Department of Science and Technology (DST).

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.

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.

The Research and Development efforts made at Ministry level and various funding organisations are enumerated here on as-and-when-available basis. The innumerable infographics have been provided here are sourced from various organisations for efficient delivery of the information and targeting the common people as the largest stakeholder. The frequently asked questions and myth busters are also answered here.

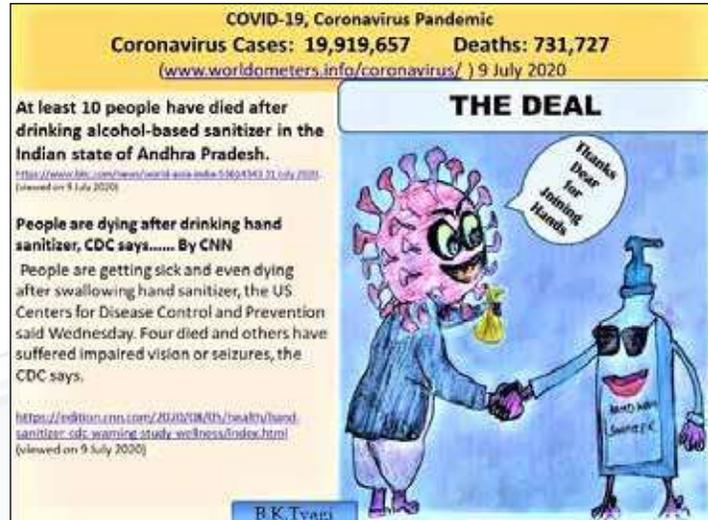
Contact Info: kdgm@vigyanprasar.gov.in

Website link:

<http://indiascienceandtechnology.gov.in/covid-19-the-pandemic>

Storytelling through Comic Characters

In the critical times of COVID-19 pandemic, our lives have changed in ways we had never imagined before. It is only natural to feel scared, stressed and saddened because of it. However, there are measures that we can take to be both physically safe and mentally healthy in these times. Dr B K Tyagi, Senior Scientist at Vigyan Prasar continues preparing some interesting awareness material with the help of comic characters for sensitising the common public and larger audience.



Contact Info: bktyagi@vigyanprasar.gov.in

Website Link:

https://drive.google.com/file/d/1FgSi8V5jkRpseFPZHncfdfs_N0jrmdaH/view

Weekly Publication of e-Newsletter on COVID-19

For the benefit of its stakeholders and target audience, VigyanPrasar is bringing out a weekly e-Newsletter on the most relevant initiatives and efforts taken by Government of India through its various Science Ministries, Departments, and Funding Organisations. These organisations are continuously striving for combating the outbreak of COVID-19. These research-driven and technology-based interventions have been initiated on war footing to fight out the outburst of the pandemic.

The e-Newsletter aims to 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 Atmanirbhar.



Contact Info: kdgm@vigyanprasar.gov.in

Website link:

<https://vigyanprasar.gov.in/covid19-newsletters/>

<http://www.indiascienceandtechnology.gov.in/covid-19-the-pandemic/newsletter-archive>

SECTION - II

Scientific Endeavours in India: Emergence to Pandemic

"The segment consists of the synopsis of all the initiatives taken after the outbreak of the pandemic to curb the menace by various Ministries & Departments of Government of India."

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

RESEARCH AND DEVELOPMENT

OFFICE OF THE PRINCIPAL SCIENTIFIC ADVISER (PSA)

The Office of the Principal Scientific Adviser (PSA) to the Government of India has the primary objective of evolving policies, strategies, and missions for the generation of innovations and support systems for multiple applications; generating science and technology tasks in critical infrastructure, economic and social sectors in partnership with Government departments, institutions and industry; and functioning as the Secretariat to the Scientific Advisory Committee to the Cabinet, with the Principal Scientific Adviser to the Government of India as its Chairman.

The PSA's Office has been actively promoting the implementation of synergy projects in various science and technology areas. The Office endeavours to bring in synergy among the various scientific departments and other ministries in creating an enabling S&T ecosystem that encourages innovations across disciplines. It encourages R&D projects in advanced high-quality basic research, directed basic research, and pre-competitive applied research through academia-industry interactions.

In the light of COVID-19 pandemic outbreak, a Task Force for focused research on corona vaccines and other S&T issues (referred to as the Vaccine Task Force, WF) Co-Chaired by Dr Vinod Paul, Member, NITI Aayog and Prof K VijayRaghavan, Principal Scientific Adviser to the Government of India has been constituted by the Prime Minister Office. The Empowered Technology Group (ETG) has been approved by the Cabinet and is chaired by Prof K VijayRaghavan. The Joint Committee of the ETG and PMO constituted Task Force met regularly to take timely policy decisions.

With the country facing an unprecedented crisis due to the coronavirus pandemic, the premier technical institutes have completely re-oriented their research ecosystem to develop solutions for the myriad issues that are coming up. This Herculean effort that lacks a parallel in modern history demands not only a significant commitment in terms of manpower and infrastructure but also a sizeable financial outlay. The industry has stepped up to do its part and help the country overcome this crisis by funding and collaborating on research projects with academia. These industry engagements are being facilitated by PSA's Office.

Title	Implementing Agency	Industry Involved
IIT Delhi developing PPE kits customised for healthcare professionals	Indian Institute of Technology (IIT) Delhi	PNB Housing Finance Limited (PNBHFL)
Development of a Novel Peptide Therapy for COVID-19 at IIT Delhi	Indian Institute of Technology (IIT) Delhi	Kisankraft Limited; Growdea Technologies Pvt. Ltd
IIT Kanpur – NOCCA develops Invasive Ventilator with IoT-enabled features	Indian Institute of Technology (IIT) Kanpur	ACT Grants; Ansys; Standard Chartered; ICICI Securities; Cummins India; Naukri.com; Ador Powertron
Cholamandalam provides funding support to IIT Madras Students to scale up production of face shields	Indian Institute of Technology (IIT) Madras	Cholamandalam
Venture Center's initiative on developing simple and low-cost face shields for healthcare workers and police forces gets support from Cummins India Foundation, Persistent Foundation & Kirloskar Brothers Ltd. Pune	CSIR-National Chemical Laboratories (NCL), Pune	Cummins India Foundation; Persistent Foundation; Kirloskar Brothers Ltd. Pune
IIT Delhi & NCL Pune developing an ELISA-based assay for COVID-19 testing	Indian Institute of Technology (IIT) Delhi; CSIR-National Chemical Laboratories (NCL), Pune	Information not available
IIT Delhi developing infection-proof fabrics	Indian Institute of Technology (IIT) Delhi	Fabiosys Innovations Private Limited; Huawei Telecommunications (I) Co. Pvt. Ltd.
IIT Madras start-ups' efforts to develop 'Portable Hospital Unit' funded by Wells Fargo	Indian Institute of Technology (IIT) Madras	Wells Fargo
Tube Investments of India Limited (Murugappa Group) funds IIT Madras project for development of Doffing Units	Indian Institute of Technology (IIT) Madras	Murugappa Group
IBPL, Pune supports Venture Center and BMek develop and donate infrared digital thermometers	Venture Center	International Biotech Park Limited (IBPL), Pune; BEL (Bharat Electronics Ltd.) Pune
Infineon Technologies provides funding support to IIT Madras start-up to develop power backup system for ventilators	Indian Institute of Technology (IIT) Madras	Infineon Technologies; Cygni Energy Pvt. Ltd.

ICMR-approved probe-free RT-PCRs for diagnosis of COVID-19 developed at IIT Delhi	Indian Institute of Technology (IIT) Delhi	Microsoft
Persistent Foundation supports TRAC study, a retrospective analysis for COVID-19	Entrepreneurship Development Center (Venture Center), Pune	Persistent Foundation
Asian Paints supports MyLab Discovery Solutions to stock emergency supply of COVID-19 testing kit – Patho Detect	MyLab Discovery Solutions	Asian Paints
Portable Fluorescence Reader to enable PCR-based tests for COVID-19 diagnosis, supported by Infineon Technologies	Indian Institute of Science (IISc), Bengaluru	Infineon Technologies
IIT Madras partners with Infosys for blockchain-based tracker technology for human-to-human transmission of contagious disease and renovation of healthcare infrastructure	Indian Institute of Technology (IIT), Madras	Infosys
IIT Jodhpur develops innovative face shield and sterilisation system for N95 masks	Indian Institute of Technology (IIT) Jodhpur	M/s Iscon Surgicals Ltd, Jodhpur; M/s Kamtech Associates Pvt Ltd, Jaipur; M/s Chempharm Industries India Pvt Ltd, Sonipat; M/s. Parappadi Technologies (P) LTD, Trivandrum; M/s Johri Digital Healthcare Ltd, Jodhpur; Mai Bharat Society, Jaipur; M/s Zintex Blue Ocean Pvt Ltd;
IIT Madras gets support from Fluor India and Capgemini for mass production of COVID-19 testing kits	Indian Institute of Technology (IIT) Madras	Fluor Daniel India Private Limited (Fluor India)
IISc builds Mobile Diagnostic Lab for COVID-19, supported by Toyota Kirloskar Motors, Tata Motors and SBI Foundation	Indian Institute of Science (IISc), Bengaluru	Toyota Kirloskar Motors; Tata Motors; SBI Foundation
NCBS & JNCASR working on epidemiological modelling	National Centre for Biological Sciences (NCBS); Tata Institute of Fundamental Research (TIFR); Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)	Punjab National Bank (PNB); The Azim Premji Foundation; Standard Chartered Global Business Service; and The Nuclear Power Corporation of India Limited (NPCIL)
IIT Ropar develops negative pressure room, now developing negative pressure ambulance, isolation rooms & ICUs	Indian Institute of Technology (IIT) Ropar	Ansys Inc; Bafna Healthcare Pvt. Ltd., Faridabad

IISc working on novel ventilator design through 'Project Praana,' supported by SBI Foundation and Infineon Technologies	Indian Institute of Science (IISc) Bengaluru	SBI Foundation; Infineon Technologies India Pvt Ltd.
Capgemini supports IISc for antibody testing for COVID-19	Indian Institute of Science (IISc) Bengaluru	Capgemini Corporation India
NCBS and inStem are working on disinfection technologies	Institute for Stem Cell Science & Regenerative Medicine (inStem); National Centre for Biological Sciences (NCBS)	Information not available
CSIR-National Aerospace Laboratories (NAL) develops PPEs and Hospital Assistive Devices in partnership with industries to fight COVID-19	CSIR-National Aerospace Laboratories (NAL)	MAF Clothing Pvt. Ltd, Bengaluru; Apollo Computing Laboratories (P) Ltd, Hyderabad; Kavitul Technologies Pvt. Ltd., Vadodra; Paras Defence & Space Technologies, Navi Mumbai; Datasol (B) Pvt. Ltd., Bengaluru; Nfotec Digital Engineering Pvt Ltd., Bengaluru; Unimech Aerospace & Manufacturing Pvt. Ltd. Bengaluru
NCBS-TIFR and inStem, Bengaluru working on pooled sampling and compressed sensing of COVID-19, supported by Punjab National Bank and Standard Chartered Global Business Service	Institute for Stem Cell Science & Regenerative Medicine (inStem); National Centre for Biological Sciences (NCBS)	Information not available
NCBS and inStem working on repurposing FDA drugs for COVID-19 treatment, supported by Punjab National Bank	Institute for Stem Cell Science & Regenerative Medicine (inStem); National Centre for Biological Sciences (NCBS)	Punjab National Bank

Here is the link for detailed information of initiatives taken up by PSA's Office to combat COVID-19:

http://psa.gov.in/sites/default/files/pdf/PSA_Office_Initiatives_COVID-19.pdf

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

RESEARCH AND DEVELOPMENT

DEPARTMENT OF SCIENCE & TECHNOLOGY (DST)

The COVID-19 pandemic in India is part of the worldwide pandemic of coronavirus disease (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). 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 chemotherapeutic interventions and an efficacious vaccine, the global population has been hit hard with utmost vulnerability to the coronavirus infections.

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 our entire startup ecosystem to identify and support the relevant technology solutions ready for scale up; over 600 relevant startups mapped; around 60 startups being supported;
- ii. A special call to support industries that have an appropriate and proven product or technology to commercialize or scale up further;
- iv. 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;
- v. A special call on scientifically identifying relevant yoga and meditation practices for immunity boosting, respiratory toning and stress reduction;
- vi. Support for a network of over 30 mid and large size NGOs for dissemination of information, training and mask/disinfectant distribution;
- vii. Activation of Survey of India in relevant digital mapping solutions;
- viii. Formation and support to a group across several IITs and AI startups to find Artificial Intelligence solutions to COVID-19 diagnostics and predictions;
- ix. Linked with technology companies such as IBM, NVIDIA etc who have agreed to provide resources such as supercomputing time and software stacks pro bono for COVID research;

- 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 of the area for formulating a Super Model for predicting the spread of pandemic. The model should be robust and trustworthy to allow confidence in its predictions for decision making.
- xii. RT-PCR Testing Centers are operational in over 10 scientific institutions based on the research facilities established there previously by 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).

Research Projects by Science & Engineering Research Board (SERB), Department of Science & Technology (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 Modeling 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 Modeling 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 Modeling 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 Covid-19	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
Modeling 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 SARSCoV-12 (COVID-19) using systems pharmacology-based network modeling	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
Modeling 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 COVID19	Indian Institute of Technology (IIT) Bhilai
Modeling 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 modeling of COVID-19 pandemic for urban areas	Atal Bihari Vajpayee Indian Institute of Information Technology and Management

Development of Dynamic Mathematical Modeling for COVID-19 Spread and Containment	National Institute of Technology, Delhi
Modeling 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 DrugBank 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 SARSCoV-2 Infection	Advanced Materials and Processes Research Institute Madya 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-CoV2 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)
DST sets up rapid response centre at SINE, IIT Bombay to combat COVID-19	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 can help interventions	IIT Bombay

For more information, visit:

<https://www.serbonline.in/SERB/HomePage>

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

RESEARCH AND DEVELOPMENT

DEPARTMENT OF BIOTECHNOLOGY (DBT)

The DBT and its PSU, Biotechnology Industry Research Assistance Council (BIRAC) together strategized both immediate and long-term research and development efforts for vaccine, diagnostics, and drug development in addition to development and production of monitoring and assistive devices and other biomedical solutions through the DBT-BIRAC COVID-19 initiative. A total of 120 grants have been recommended to be awarded across industry, academia, and Industry-Academia collaborations. This consortia platform aimed at leveraging capacity and strengths established across the pyramid of academicians, researchers, innovators, large industries, and MSMEs and to prioritize research and scientific interventions so as to deliver solutions for the pandemic.

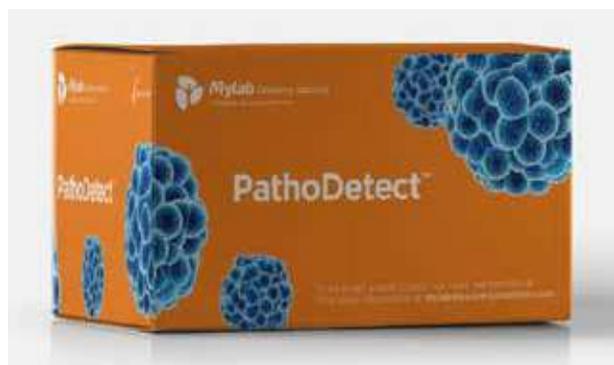
Major efforts are ongoing under the National Biopharma Mission and Ind-CEPI (Coalition for Epidemic Preparedness Innovations). Some of notable scientific and technical achievements are as follows:

- The plasmid DNA vaccine (ZyCoV-D) from Cadila Healthcare has completed enrolment for Phase I trial and is poised to initiate recruitment for Phase II human clinical trials.



- The recombinant BCG candidate (VPM1002) from Serum Institute of India Pvt Ltd (SIPL) completed enrolment of 6000 high-risk subjects across 40 hospitals in the Phase III clinical trials.
- The m-RNA vaccine candidate from Gennova Biopharma progressed well in the preclinical development and is expected to enter human clinical trials before the year end.
- Hyderabad-based Virchow Biotech (P) Ltd is expected to enter into human clinical trials shortly for Immunoglobulin (antibody) therapy purified from the plasma of COVID-19 recovered patients.

- Pune-based Mylab Discovery Solutions has scaled its production and development of COVID-19 PathoDetect testing kit. Currently, Mylab has a manufacturing capacity of 2,00,000 RT-PCR and 50,000 RNA tests.
- Ubio Biotechnology Systems Pvt Ltd received the manufacturing license for rapid antigen test.



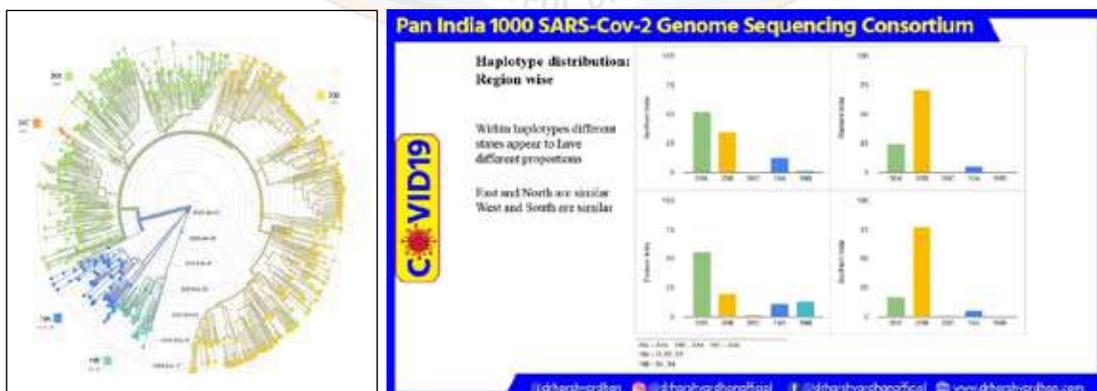
The health-tech start-ups were supported to scale-up the existing solutions relevant for COVID-19 and some of them are Aarna Biomedical Products (Suraksha Full Body Coverage Kit); Alpha Corpuscles (Face shields); MicroGO (GO Assure- automated hand hygiene device); Cistron Systems (PSA medical oxygen generators); Ubiquare Health (Specialty mobility healthcare platform); and Ayu Devices (Bluetooth-enabled Digital Stethoscope for COVID-19). Additionally, BIRAC has also approved support to two co-funding partners (IKP and C-CAMP) for funding up to 25 start-ups its mandate to foster market deployment of innovative solutions addressing COVID-19 challenges.

DBT along with BIRAC is also working to facilitate regulatory support to start-ups through its FIRST HUB initiative. Representatives from ICMR, CDSCO, and GeMetc join for special weekly sessions that are being run every Friday to address the queries of start-ups in wake of the COVID-19 crisis. Regulatory facilitation of more than 250 start-ups was done through FIRST HUB and RIFC (Regulatory Information & Facilitations Centre).

National Biomedical Resource Indigenization Consortium (NBRIC) was launched to drive indigenous innovation in a Public-Private Partnership with DBT, BIRAC, ABLE, and C-CAMP. This 'Make in India' initiative is an important step towards building a self-reliant India. Over 40 companies have till now partnered to develop RT-PCR Kits and its associated reagents and consumables along with serological tests/lateral flow assays and its associated reagents and consumables under NBRIC.

SARS-CoV-2 genomics study

DBT-NIBMG is coordinating the “PAN-India 1000 SARS-CoV-2 RNA Genome Consortium”, a multi-institutional effort involving other DBT AIs, viz., CDFD, ILS, inStem-NCBS, and NCCS, initiated to undertake research on host and viral genomics. The Consortium successfully completed sequencing of 1000 genomes from different geographical regions of India.



R&D Projects supported under the DBT-BIRAC Research Consortia

BIRAC-Supported R&D Projects

S. No.	Title of Project	Implementing Institution
Diagnostics		
1	Development of a point-of-care Lateral Flow Diagnostic Platform for detection of viral antigens and antibodies IgG & IgM of SARS-CoV-2 enabling efficient and swift diagnosis and mass screening.	Rajiv Gandhi Centre for Biotechnology
2	Diagnostic kit for detection of the virus via swab testing	Levram Lifesciences Pvt Ltd
3	Development of highly sensitive & specific, rapid, point-of-care, low-resource-requiring, colorimetric and cost-effective test for COVID-19 detection	SHC Shinebiotech Pvt Ltd
4	Scale-up manufacturing of PathoDetect 2019-nCoV Detection Kit rapidly to meet the current demand in India during national crisis	Mylab Discovery Solutions Pvt Ltd
5	Development of a point-of-care Lateral Flow Diagnostic Platform for detection of viral antigens and antibodies IgG & IgM of SARS-CoV-2 for validation and deployment	Ubio Biotechnology Systems Pvt Ltd
6	A rapid, cost-effective IgM/IgG lateral flow in vitro diagnostic (IVD) strip test for rapid point-of-care screening of COVID-19 cases and population-level screening for immunity monitoring	SciGenom Labs Pvt Ltd in collaboration with Anamol Laboratories, Navi Mumbai, Christian Medical College (CMC), Vellore
7	Development and validation a real-time RT-PCR test for detection of SARS-CoV-2 virus for COVID-19 diagnosis; RNA extraction and RT kits; automated sample prep and RNA extraction system; affordable battery-operated qPCR platform	Yaathum Biotech Pvt Ltd
8	Development of a quantitative ELISA kit for COVID-19 diagnosis	Achira Labs Pvt Ltd
9	COVID MedTech Manufacturing & Development Strategy (CoMMAND Strategy); Point-of-care diagnostic kit for COVID-19 based on PCR technology; Point-of-care serological test anti-body-based; Ventilator	Andhra Pradesh MedTech Zone
10	Molecular diagnosis of COVID-19 multiplex assay along with screening for other related respiratory diseases	Huwel Lifesciences Pvt Ltd
Therapeutics		
11	Immunotherapy of COVID-19-infected patients using therapeutic antibodies from human or equine sources	Virchow Biotech Pvt Ltd
10	Development of human monoclonal antibodies for SARS-Cov-2 from convalescent patient blood	Bioclone Biotech Pvt Ltd
Vaccines		
11	Development of DNA vaccine against SARS-CoV-2	Cadila Healthcare Ltd
12	COVID-19 vaccine based on a safe inactivated rabies vector platform	Bharat Biotech International Ltd

13	Phase III, double-blind, randomized, placebo-controlled study to evaluate the duration of acute respiratory symptoms among exposed high-risk population during COVID-19 pandemic by enhanced trained immune response through VPM1002 rBCG vaccine	Serum Institute of India Pvt Ltd
14	A novel vaccine evaluation platform to support SARS-CoV-2 vaccine development in resource-limiting settings	National Institute of Immunology, New Delhi
15	Development of a novel m-RNA vaccine against SARS-CoV-2	Gennova Biopharmaceuticals Ltd

Diagnosics

16	Development of lateral flow test for the detection of anti-SARS-CoV-2 IgG & IgM from human sera	Dhiti Life Sciences Pvt Ltd
17	Artificial Intelligence algorithm for automatic screening of COVID-19 patients from chest X-Rays and chest CT scans	Endimension Technology Pvt Ltd
18	Electrochemical paper stamp for a self-swab RNA test of COVID-19	Biyani Biosolutions Pvt Ltd
19	COVID-19 antibody-based kit development for rapid diagnosis and surveillance	Prantae Solutions Pvt Ltd
20	Development and commercialization of affordable, sensitive, specific, and quick diagnostics like Rapid, ELISA and NAT for COVID-19	Promea Therapeutics Pvt Ltd
21	Development and evaluation of aptamer-based lateral flow assay kit for detection of SARS-CoV-2 detection.	IIT-Delhi-Vanguard diagnostics Pvt Ltd

DBT-Recommended R&D Projects

S. No.	Title of the project	Implementing Institution
Diagnostic		
1	Point-of-care device for COVID-19 detection	IIT Hyderabad
2	Fluorescence and Electrochemistry-Mediated Rapid Detection of SARS-CoV-2 Nucleic Acid from Biological Samples	Bennett University, Greater Noida
3	Development of a monoclonal antibody-based diagnostic method for the specific detection of COVID-19 viral antigens	Vellore Institute of Technology, Vellore
4	COVID-19: Reverse zoonosis and its role in re-emergence	BHU, Banaras
5	Relationship between digestive symptoms and morbidity, mortality and faecal excretion of the virus among patients with COVID-19: A possible diagnostic role of faecal sample and potential for feco-oral transmission	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow
6	A low-cost portable microfluidics embedded on chip rRT-PCR and microelectrode array-coupled point-of-care optoelectronic device for large-scale screening of emerging viral disease like SARS-CoV-2	JNU, Delhi
7	Non-invasive, Rapid, Specific and Sensitive Electrochemical Biosensor for COVID-19 Infection	Central Electrochemical Research Institute, Tamil Nadu
8	Development of Isothermal-PCR and CRISPR-Cas 12-based rapid and portable SARS-CoV-2 COVID-19 detection kit	Gautam Budha University, UP

9	Paper-based devices for thermal cycler-free molecular diagnostics of COVID-19	IISc, Bangalore
10	Developing a real-time PCR coupled with a rapid in-house RNA extraction for the diagnosis of COVID-19	IIT Delhi
11	Diagnostic solutions for SARS-CoV-2	THSTI, Faridabad
12	A one-hour PCR-free method of detection of SARS-CoV-2 infections by RT-LAMP technique	National Institute of Immunology, New Delhi
13	Development of SARS-CoV-2 ELISA for SERO SURVILLANCE - A cost-effective approach for sero surveillance and profiling sera for SARS-CoV-2 antibodies	Centre for Human Genetics, Bengaluru
14	Development of kit for simultaneous isolation of viral RNA by magnetic nanoprobe and rapid detection of novel coronavirus by highly luminescent gold nanoclusters	IIIT, Allahabad
15	Development of PCR-free, facile luminescence-based kit for ultra-sensitive detection of COVID-19	National Institute of Immunology, New Delhi
16	A simple colorimetric diagnostic technique for novel coronavirus detection	Institute of Chemical Technology, Mumbai
17	COVID-19 pandemic management based on real-time detection of airborne viral load in hospitals	Thapar University

Therapeutics

S. No	Project Title	Implementing Institution
1	High-affinity binders against COVID-19 spike protein using display libraries	Institute for Stem Cell Science and Regenerative Medicine, Bengaluru
2	Investigating SARS-CoV-2 3'-5' exonuclease NSP14/ExoN as a target for CoVID-19 therapeutic interventions	Institute of Genomics and Integrative Biology-IGIB, New Delhi
3	Hunt for Panacea Pan-CoV antiviral for the Coronaviruses of the past, present and future	National Institute of Animal Biotechnology, Hyderabad
4	New therapeutics against SARS-CoV-2: Analyzing small molecule chemical libraries by establishing targeted cell-based assays for inhibitors of viral entry and viral protease	RGCB, Thiruvanthapuram
5	Identifying therapeutic targets for blocking infection of highly pathogenic SARS-CoV-2 at an early stage: Developing novel screening assay with minimal bio-hazard risk	Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow
6	Are fusion inhibitors potential pan-coronavirus therapeutic agents?	Christian Medical College, Vellore
7	Synthesis and anti-viral evaluation of newly designed nucleoside analogues beyond repurposing through revamping against emerging coronavirus 2019-nCoV/SARS-CoV-2 by computational protocols	Osmania University, Hyderabad
8	Virtual and in vitro screening of spiropyrrolidine derivatives and Diverset core library small molecules to identify SARS-CoV-2 entry, fusion and protease inhibitors: An anti-COVID-19 drug discovery and development programme	Central University of Tamil Nadu
9	Dry Powder Inhalation Containing Biodegradable Nanoparticles of Niclosamide to Combat COVID-19 Infection	Dadasaheb Balpande College of Pharmacy

10	Development of Anti-viral Peptide Aptamers for SARS-CoV-2: Design and Evaluation	Madurai Kamaraj University, Madurai
11	Inhibition of interaction between receptor-binding domain of spike protein of SARS-CoV-2 and human ACE2 by protein mimic DNA	IIT, Hyderabad
12	A longitudinal study of COVID-19-infected patient samples for convalescent plasma therapy	Indian Institute of Technology, Bombay
13	Functional analysis of BCG primed macrophages to clear SARS-CoV-2 virus and to assess potential role of BCG as a prophylactic agent in hamster model of infection	National Institute of Cholera and Enteric Diseases, Kolkata

Vaccines (All are in pre-clinical stage of development)

S. No	Approach Taken (Vaccine platform and Type of Candidate)*	Institute
1	Spike mRNA encapsulated in lipid nanoparticles as a synthetic vaccine for SARS-CoV-2	Centre for Stem Cell Research, CMC Vellore
2	Intranasal vaccine	Institute of Chemical Technology, Mumbai
3	Systematic assembly of SARS-CoV-2 full-length and subgenome cDNA clones	Shiv Nadar University
4	Development of hACE2 expressing bone marrow chimera mouse model and development of a dendritic cell-based vaccine	National Institute of Immunology
5	Development of SARS-CoV-2 Virus Like Particle VLP as a potential vaccine candidate	National Institute of Biomedical Genomics
6	E. coli expressed RBD conjugated to CRM or Pneumo	National Institute of Immunology
7	Recombinant subunit vaccine with hepatitis B	International Centre for Genetic Engineering and Biotechnology
8	Self-amplifying mRNA Vaccine	Translational Health Science and Technology Institute
9	Recombinant sub unit vaccine using spike protein ectodomain and Receptor binding domain (RBD) as self-assembled particles as vaccine antigens	Translational Health Science and Technology Institute
10	Synthetic antigen-based vaccine eliciting IgA	National Centre for Cell Science

Other Interventions

S. No	Title of Project	Implementing Institution
1.	"Accessories for affordable mask for preventing pandemic outbreak"	IIT Bombay
2.	Low-cost, lightweight, portable, cross-contamination free mechanical suction system for removal of mucosal plugs in SARS-CoV-2 induced Pneumonia	Thapar University, Patiala

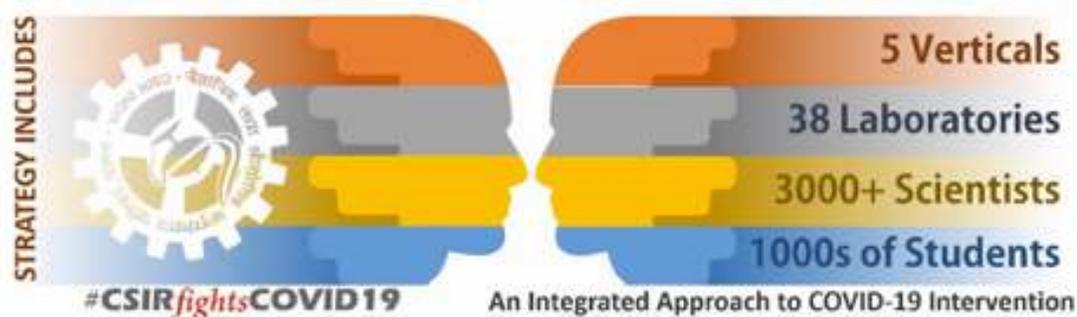
3.	Development of disinfection systems for the prevention and spread of COVID-19 through indoor air and wastewaters	Indian Institute of Technology, Indore
4.	Biodegradable Antiviral Mask to Combat COVID-19	SVKM's Narsee Monjee Institute of Management Studies, Mumbai
5.	Effective implementation of reverse quarantine strategy using novel M health technology and community participation for control and prevention of COVID-19 – pilot study from Kerala	Believers Church Medical College Hospital, Thiruvalla, Kerala.

**SCIENTIFIC ENDEAVOURS IN INDIA:
EMERGENCE TO PANDEMIC**

RESEARCH AND DEVELOPMENT

**COUNCIL OF SCIENTIFIC &
INDUSTRIAL RESEARCH (CSIR)**

CSIR has advantageously positioned itself to pursue focused research and development (R&D) to develop, integrate, scale-up, and deploy necessary technological interventions for combating Coronavirus pandemic in the country. Considering the multifarious problems caused by coronavirus which require multi-fold interventions and multi-pronged strategy, CSIR has set up five technology verticals to fight COVID-19 pandemic. These verticals include surveillance, diagnostics, drugs, hospital assistive devices and supply chain. The approach is need based, span multiple research labs and disciplines and draw upon the strength of scientists and students in the fight against COVID-19.



CSIR is funding several R&D proposals from industry and start-ups under New Millennium Indian Technology Leadership Initiative (NMITLI) scheme for developing technical interventions against COVID-19. These proposals are related to various thrust areas of research which includes New/Repurposed Drugs, Effective Containment Interventions, New/Repurposed Vaccines, Assistive Devices, Innovative Diagnostics and Track-and-Trace Technologies.

With its proven expertise in sequencing (first human genome sequencing), diagnostics for rare genetic diseases and being the fountain head of generic industry in the country, among other things, CSIR is uniquely placed to deliver COVID-19 interventions. The Council is working in close synergy with other government departments, ministries and agencies on the one hand and with industries, MSMEs and others for scale up, delivery and implementation on the other.

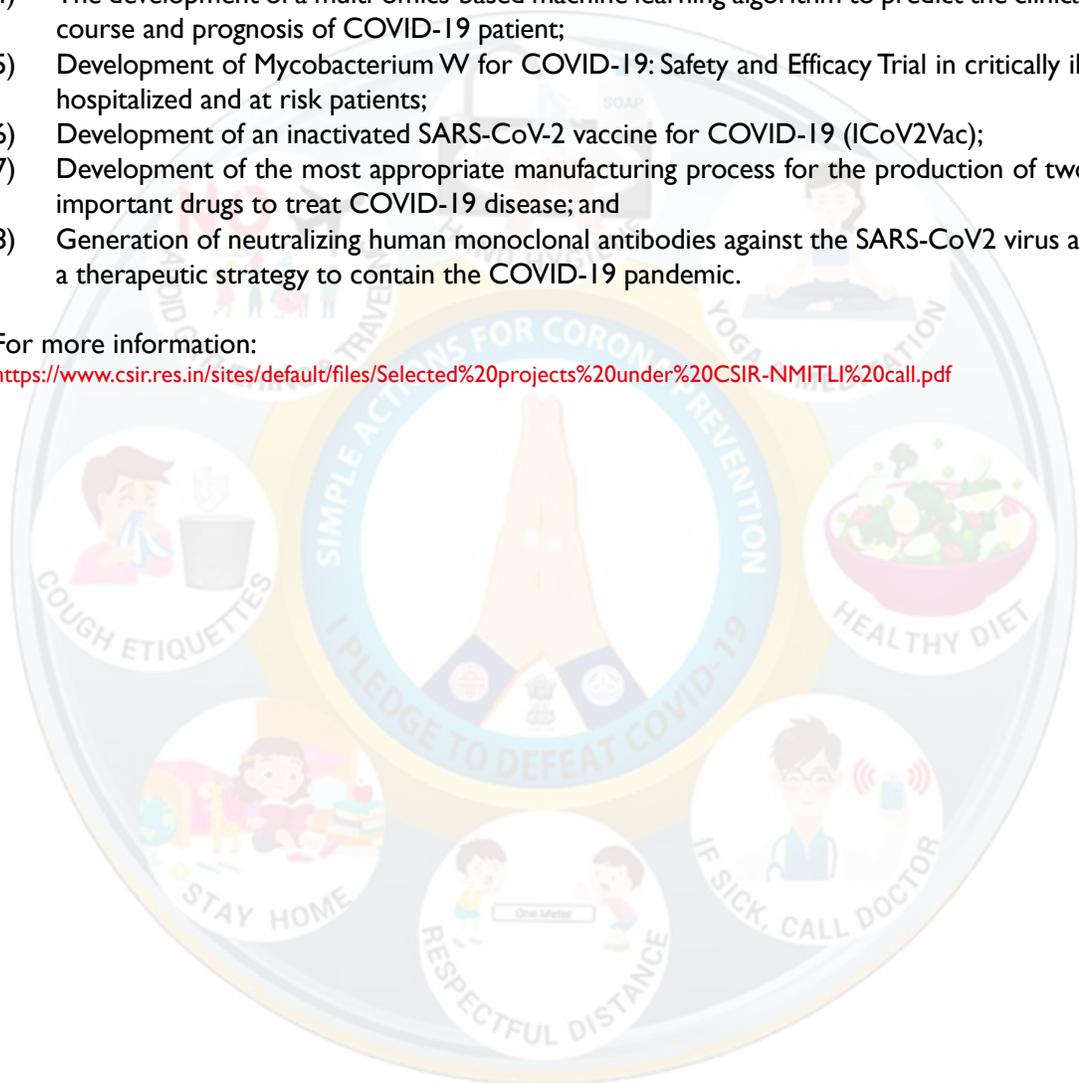
CSIR is closely working with various industries including Reliance India Limited (PPEs and diagnostics), Tata Sons (diagnostics, hospital assistive devices, rural entrepreneurship), Unilever (zinc gluconate and proline complex and rural entrepreneurship), Intel (digital surveillance),

TCS (digital surveillance and supply chain platform), Cadila (MW as therapy for coronavirus), Cipla (repurposed drugs), BHEL (electrostatic spray and ventilator), Bharat Biotech (inactivated vaccine development), Bharat Electronics (oxygen enrichment unit), MAFL (PPEs) and so on. Here is a glimpse of some selected COVID-19-centric research projects under CSIR-NMITLI funded by CSIR:

- 1) Development of an indigenous, affordable 'neonatal to adult' ventilator to be used for mechanically ventilating multiple patients with respiratory failure, simultaneously;
- 2) Development of a Portable Respiratory Assistive Device;
- 3) Development of an accurate, affordable point-of-care Diagnostics kit for COVID-19;
- 4) The development of a multi-omics-based machine learning algorithm to predict the clinical course and prognosis of COVID-19 patient;
- 5) Development of Mycobacterium W for COVID-19: Safety and Efficacy Trial in critically ill, hospitalized and at risk patients;
- 6) Development of an inactivated SARS-CoV-2 vaccine for COVID-19 (ICoV2Vac);
- 7) Development of the most appropriate manufacturing process for the production of two important drugs to treat COVID-19 disease; and
- 8) Generation of neutralizing human monoclonal antibodies against the SARS-CoV2 virus as a therapeutic strategy to contain the COVID-19 pandemic.

For more information:

<https://www.csir.res.in/sites/default/files/Selected%20projects%20under%20CSIR-NMITLI%20call.pdf>



SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

RESEARCH AND DEVELOPMENT MINISTRY OF AYUSH

Alternative medicines are being used by about 60 per cent of the world's population. These medicines are not only used by the rural masses for their primary healthcare in developing countries but are also used in developed countries where modern medicines dominate. In the current scenario of the ongoing pandemic, when there seems to have no immediate solution to the exiting crisis, the only remedy available to the humankind is the prevention. The most precise prevention is boosting of the immunity. India is famous worldwide for its traditional medical wisdom and in treating diseases through medicinal plants.

Medicinal plants-based traditional systems of medicines have played an important role in providing healthcare to large section of population, especially in developing countries. Interest in them and utilization of herbal products based on them have increase in the present situation. Indian Systems of medicine are among the well-known global traditional systems of medicine. The Indian subcontinent is a vast repository of medicinal plants that are used in traditional medical treatments. The alternative medicines in the traditional systems are derived from herbs, minerals, and organic matter, while for the preparation of herbal drugs only medicinal plants are used.

In India, the apex government body responsible for traditional medicinal system is the Ministry of AYUSH or the Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH). It works with a view to provide focused attention for the development of Education and Research in Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy. The ministry is responsible for ensuring a time-bound research programme on identified diseases for which these systems have an effective treatment and to evolve Pharmacopoeia Standards for Indian Systems of Medicine and Homoeopathy drugs.

The following research project details the action taken by the Ministry of AYUSH in combating the COVID-19 crisis. The efforts have been categorised under various heads for clear viewpoint. Detailed information could be sought through the respective links.

Title	Institute
Therapeutic Effectiveness of the Siddha Immuno Modulatory Polyherbal Formulation Nellikai Legiyam Against Covid-19 Pandemic- A Review	National Institute of Siddha, Chennai
Journal: WORLD JOURNAL OF PHARMACEUTICAL RESEARCH https://wjpr.net/dashboard/abstract_id/14689	

<p>Siddha Concepts in Diagnosis and Management of COVID-19</p> <p>Scholars Journal of Applied Medical Sciences https://saspublishers.com/media/articles/SJAMS_86_1633-1638.pdf</p>	National Institute of Siddha, Chennai
<p>Pragmatic Approach Towards The Role of Unani Medicine in the Prevention Of Covid-19:A Review</p> <p>WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES https://www.wjpps.com/Wjpps_controller/abstract_id/12375</p>	Regional Research Institute of Unani Medicine, Srinagar
<p>Role of Unani Medicine in Prevention and Treatment of Waba (Epidemics) including COVID-19:A Review</p> <p>EUROPEAN JOURNAL OF CELL SCIENCE http://ayushportal.nic.in/pdf/164654.pdf</p>	National Institute of Unani Medicine, Kottigepalya, Bengaluru
<p>Overview of Covid-19; its prevention and management in the light of Unani medicine</p> <p>SCIENCE OF THE TOTAL ENVIRONMENT http://ayushportal.nic.in/pdf/164653.pdf</p>	Jamia Hamdard, New Delhi Jamia Millia Islamia Campus, New Delhi
<p>Ayurvedic clinical profile of COVID-19 - A preliminary report</p> <p>JOURNAL OF AYURVEDA AND INTEGRATIVE MEDICINE https://europepmc.org/article/pmc/pmc7290222</p>	Amrita School Of Ayurveda, Kerala; Medanta Institute of Education & Research, Gurgoan; Ashtamgam Ayurveda Chikitsalayam and Vidyapeedham, Kerala
<p>Ayurveda and COVID-19:Where psychoneuroimmunology and the meaning response meet</p> <p>BRAIN, BEHAVIOR, AND IMMUNITY http://ayushportal.nic.in/pdf/164651.pdf</p>	Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry
<p>AYUSH for COVID-19 management</p> <p>JOURNAL OF AYURVEDA AND INTEGRATIVE MEDICINE https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7319636/#:~:text=Health%20promoting%20immunomod</p>	Savitribai Phule Pune University, Pune; Pulmocare Research and Education (PURE) Foundation, Pune;
<p>Reactions from Traditional Medical Systems to COVID-19 outbreak:Time to tread cautiously</p> <p>JOURNAL OF AYURVEDA AND INTEGRATIVE MEDICINE http://ayushportal.nic.in/pdf/164649.pdf</p>	National Institute of Epidemiology (ICMR-NIE), Chennai
<p>Siddha Concepts in Diagnosis and Management of COVID-19</p> <p>SCHOLARS JOURNAL OF APPLIED MEDICAL SCIENCES https://saspublishers.com/media/articles/SJAMS_86_1633-1638.pdf</p>	National Institute of Siddha, Chennai

<p>AYUSH Systems of Medicine, a Viable Solution for COVID-19 amidst the Uncertainty of Vaccination & Herd Immunity - an Indian Perspective</p> <p>ASIAN JOURNAL OF PHARMACEUTICAL RESEARCH AND HEALTH CARE</p> <p>http://ayushportal.nic.in/ShowRslt2.aspx?IDD=164646</p>	<p>Homoeopathic Clinical Research Unit, Hyderabad</p>
<p>Preventive strategies to combat infections—a review of traditional practices and Ayurveda concepts</p> <p>INTERNATIONAL JOURNAL OF COMPLEMENTARY & ALTERNATIVE MEDICINE</p> <p>http://ayushportal.nic.in/pdf/164645.pdf</p>	<p>Regional Ayurveda Research Institute for Metabolic disorders, India</p>
<p>World Homoeopathy Day 2020: Connecting digitally during the adversities of COVID19 lockdown</p> <p>INDIAN JOURNAL OF RESEARCH IN HOMEOPATHY</p> <p>http://ayushportal.nic.in/pdf/164644.pdf</p>	<p>Central Council for Research in Homoeopathy, New Delhi</p>
<p>Enabling use of Homoeopathy in India's preparedness for pandemic/ epidemic situation like COVID19</p> <p>INDIAN JOURNAL OF RESEARCH IN HOMEOPATHY</p> <p>http://ayushportal.nic.in/pdf/164642.pdf</p>	<p>Central Council for Research in Homoeopathy, New Delhi</p>
<p>A review on the role of Homoeopathy in epidemics with some reflections on COVID19 (SARSCoV2)</p> <p>INDIAN JOURNAL OF RESEARCH IN HOMEOPATHY</p> <p>http://ayushportal.nic.in/pdf/164641.pdf</p>	<p>Central Council for Research in Homoeopathy, New Delhi</p>
<p>Psychological implications during the outbreak of COVID19 and its homoeopathic management</p> <p>INDIAN JOURNAL OF RESEARCH IN HOMEOPATHY</p> <p>http://ayushportal.nic.in/pdf/164640.pdf</p>	<p>National Homoeopathy Research Institute in Mental Health, Kottayam, Kerala,</p>
<p>An online crosssectional survey on knowledge, attitudes, practices and perspectives of homoeopathic practitioners towards COVID19</p> <p>INDIAN JOURNAL OF RESEARCH IN HOMEOPATHY</p> <p>http://ayushportal.nic.in/pdf/164639.pdf</p>	<p>Central Council for Research in Homoeopathy, New Delhi</p>
<p>Modified Bhramari Pranayama in COVID-19 Infection</p> <p>INDIAN JOURNAL OF OTOLARYNGOLOGY AND HEAD AND NECK SURGERY</p> <p>https://link.springer.com/article/10.1007%2Fs12070-020-01883-0</p>	<p>Indian Institute of Ear Diseases, New Delhi</p>
<p>Yoga for infirmity in geriatric population amidst COVID-19 pandemic</p> <p>ASIAN JOURNAL OF PSYCHIATRY</p> <p>https://www.sciencedirect.com/science/article/pii/S1876201820303117</p>	<p>All India Institute of Medical Sciences, New Delhi</p>
<p>A perspective on yoga as a preventive strategy for coronavirus disease 2019</p> <p>INTERNATIONAL JOURNAL OF YOGA</p> <p>http://www.ijoy.org.in/article.asp?issn=0973-6131;year=2020;volume=13;issue=2;page=89;epage=98;aulast=Nagarathna</p>	<p>Swami Vivekananda Yoga Anusandhana Samsthana, Bengaluru</p>

<p>Immunomodulatory Herbs of Ayurveda and Covid-19:A Review Article</p> <p>JOURNAL OF AYURVEDA AND INTEGRATED MEDICAL SCIENCES https://www.jaims.in/index.php/jaims/article/view/1152</p>	<p>Banaras Hindu University, Varanasi, Uttar Pradesh</p>
<p>INDIA FIGHT SARS CoV-2: Role of AYUSH to Fight Against Corona Virus Globally</p> <p>THE JOURNAL OF RESEARCH AND EDUCATION IN INDIAN MEDICINE http://www.jreim-ayushjournal.com/?mno=102465</p>	<p>Banaras Hindu University, Varanasi, Uttar Pradesh</p>
<p>Iyya Irumal (Identical To Covid - 19) - Its Pathological Aspects and Management Theories in Siddha</p> <p>IOSR JOURNAL OF DENTAL AND MEDICAL SCIENCES (IOSR-JDMS) https://www.iosrjournals.org/iosr-jdms/papers/Vol19-issue6/Series-6/E1906061730.pdf</p>	<p>National Institute of Siddha, Chennai</p>
<p>Viral Epidemics and traditional health care systems: It's time to act honestly, proactively and collectively</p> <p>ANNALS OF AYURVEDIC MEDICINE https://www.aamjournal.in/index.php?mno=95594</p>	<p>Annals of Ayurvedic Medicine</p>
<p>COVID-19:A promising cure for the global panic</p> <p>SCIENCE OF THE TOTAL ENVIRONMENT http://ayushportal.nic.in/pdf/164485.pdf</p>	<p>Bharathiar University, Coimbatore; Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore; Central University of Nagaland, Nagaland; Thiruvalluvar University, Vellore; Mizoram University (A Central University), Aizawl; Vision Research Foundation, Chennai</p>
<p>Public Health Approach of Ayurveda and Yoga for COVID-19 Prophylaxis</p> <p>THE JOURNAL OF ALTERNATIVE AND COMPLEMENTARY MEDICINE http://ayushportal.nic.in/pdf/164475.pdf</p>	<p>Savitribai Phule Pune University, Pune</p>
<p>Telemedicine for Ayurveda consultation: Devising collateral methods during the COVID-19 lockdown impasse</p> <p>JOURNAL OF AYURVEDA AND INTEGRATIVE MEDICINE http://ayushportal.nic.in/pdf/164474.pdf</p>	<p>State Ayurvedic College and Hospital, Lucknow</p>
<p>Time to tread cautiously during public health emergencies: Reactions from traditional and complementary/alternative medical systems to Q4 ongoing Coronavirus (COVID-19) outbreak</p> <p>JOURNAL OF AYURVEDA INTEGRATIVE MEDICINE http://ayushportal.nic.in/pdf/164473.pdf</p>	<p>National Institute of Epidemiology (ICMR-NIE), Chennai</p>

Ayurveda's Holistic Lifestyle Approach for the Management of Coronavirus disease (COVID-19): Possible Role of Tulsi INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES http://ayushportal.nic.in/pdf/164472.pdf	R D Gardi Medical College, Ujjain, Madhya Pradesh
COVID-19 pandemic:A pragmatic plan for ayurveda intervention JOURNAL OF AYURVEDA AND INTEGRATIVE MEDICINE http://ayushportal.nic.in/pdf/164471.pdf	State Ayurvedic College and Hospital, Lucknow; Department of Environment/Forests, Government of Rajasthan, Secretariat, Jaipur; Banaras Hindu University, Varanasi
Time to realise the true potential of Ayurveda against COVID-19 BRAIN, BEHAVIOR, AND IMMUNITY http://ayushportal.nic.in/pdf/164470.pdf	Indian Institute of Public Health, Gandhinagar
Novel corona Virus (2019-nCoV) - An Ancient Ayurveda Epidemiology Literature Review National Journal of Research in Ayurved Science http://ayushportal.nic.in/pdf/164469.pdf	KGMPA College & Hospital, Mumbai
Threats and challenges of emerging viral diseases and scope of Ayurveda in its prevention An International Quarterly Journal of Research in Ayurveda http://ayushportal.nic.in/pdf/164468.pdf	I.P.G.T. and R.A., GAU, Jamnagar, Gujarat

Additional research projects supported by MoAYUSH:

1. Clinical research studies on Ayurveda interventions as prophylaxis and as an add on to standard care to COVID-19: Collaborative clinical studies as a joint initiative of Ministry of AYUSH, Ministry of Health and Family Welfare (MoHFW), and the Ministry of Science & Technology through Council of Scientific & Industrial Research (CSIR) with technical support of ICMR
2. Population-based interventional studies on impact of AYUSH-based prophylactic interventions
3. Ayush Sanjivani application-based study for impact assessment of acceptance and usage of AYUSH advisories in its role in prevention of COVID-19
4. Drug Trial to Evaluate Efficacy and Safety of an Ayurvedic Formulation AYUSH-64 as Adjunct Treatment to Standard in COVID-19
5. Evaluation of Efficacy and Safety of Ayurveda Intervention (Ayush-64) add-on therapy for patients with COVID-19 infection (Stage I)-A Randomized controlled clinical trial
6. Evaluation of the efficacy of an Ayurvedic intervention (Chyawanprash) in the prevention of COVID-19 among Healthcare Personnel
7. Impact of Ayurvedic Interventions in prevention of COVID-19 infection in identified containment area
8. Interventional study on the effect of AYUSH as a prophylactic measure among high-risk population (Healthcare Workers/Containment Zone population) exposed to COVID-19

For more information, visit:
<http://ayushportal.nic.in/Covid.aspx>

**SCIENTIFIC ENDEAVOURS IN INDIA:
EMERGENCE TO PANDEMIC**

INNOVATION & TECHNOLOGY

**DEPARTMENT OF
SCIENCE & TECHNOLOGY (DST)**

As part of initiatives of some of 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. A summary of these initiatives are enlisted as under:

DIAGNOSTIC KITS RELATED

- SCTIMST develops a diagnostic test kit that confirms COVID-19 in 10 min. The Confirmatory diagnostic test detects the N Gene of SARS- COV2 using reverse transcriptase loop-mediated amplification of viral nucleic acid (RT-LAMP) - one of world's first few.
- Sree Chitra Tirunal Institute develops magnetic nanoparticle-based RNA extraction kit for PCR and LAMP tests for COVID-19
- Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in partnership with VNIR Biotechnologies Private Limited, a startup 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.
- DST provided support to Seagull BioSolutions, Pune, a startup working on new biological technologies to undertake the development of Active Virosome (AV)-Vaccine and Immunodiagnostic kits for tackling COVID-19 emergency.
- DST has funded Module Innovations, a Pune-based healthcare startup working on the point-of-care diagnostics to develop a test kit for detecting COVID-19 within 10 to 15 minutes.
- DST has funded FastSense Diagnostics, a start-up to develop a rapid diagnostic kit for the screening of COVID-19.
- 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.

- 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.
- 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.
- 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

- 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.
- SCTIMST, an institute of National Importance of the DST, tied up with Wipro 3D, Bengaluru to jointly build up on a prototype of an emergency ventilator system based on Artificial Manual Breathing Unit (AMBU)

DISINFECTANTS RELATED

- Scientists at SCTIMST, Trivandrum have designed and developed a disinfected barrier-examination booth for examining COVID-19 patients
- Scientists at Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum, Kerala, 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.
- A technology developed under the NIDHI PRAYAS program 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.
- DST & DBT have jointly supported and funded Weinnovate Biosolutions, a Pune based startup, to develop a non-alcoholic aqueous-based colloidal silver solution uniquely made from its NanoAgCide technology for disinfecting hands and environmental surfaces.
- International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), 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.
- Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, in partnership with Vehant Technologies, Noida developed KritiScan® UV Baggage Disinfection System.
- 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), Trivandrum and VST Mobility Solutions, a Startup 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 at his office, the administrative headquarters of the district.

PPE- MASKS, SANITIZERS, ETC RELATED

- DST supported startup named as Green Pyramid Biotech (GPB), Pune to make natural, alcohol-free sanitizer 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. The upscaling will be carried out in association with two industrial partners Resil Chemicals Pvt Ltd. Bangalore and Nanoclean Global Pvt Ltd., New Delhi.
- A team of researchers at the Centre for Nano and Soft Matter Sciences (CeNS), Bangalore, 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.

DISINFECTANTS RELATED

The organizations supported by DST had developed various assistive tools, technologies and techniques, that are affordable and adaptable to Indian milieu to mitigate the impact of COVID-19 among Divyangjan and Elderly for creating inclusiveness and universal accessibility

e-Tool to support Intellectually Disabled during COVID-19 Pandemic:

The e-Tool (CD/Web based tool) developed by Rajalakshmi Engineering College, Chennai creates awareness and imparts health and hygiene related information along with education and entertainment to overcome loneliness due to COVID-19 pandemic for the persons with



mild and moderate cognitive disabilities

Screenshot of the e-Tool showing different components of the software/app

Wearable device for fall prediction, detection and activity monitoring:

The wearable device developed by PSG College of Technology, Coimbatore remotely monitors the activities of elderly/differently abled patients who happen to be under quarantine or



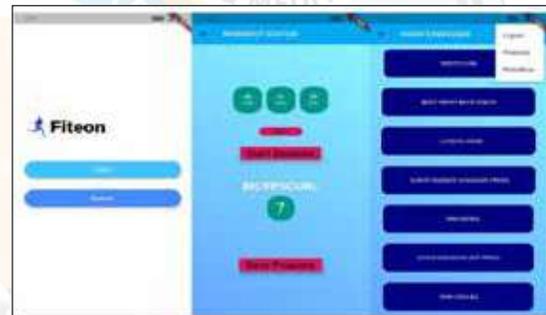
isolation wards amid COVID-19 crisis.

Wearable Device

Sensor Configuration

Virtual Physiotherapist for In-Home Rehabilitation

PSG College of Technology, Coimbatore has developed a wearable device to assist people under rehabilitation with real time monitoring and feedback of their recovery process through guided rehabilitation protocols. The device will help the elderly to get quantified outcomes regarding the improvement in the muscle strength, muscle flexibility and muscle endurance



during the course of rehabilitation, without direct and physical interventions from doctors/physiotherapists.

Wearable Rehabilitation Band

User Interface of the Mobile App

Technologies developed by initiatives from Technology Development Board (TDB)

Thermal Scanners

TDB has approved financial assistance to two Bangalore based companies, Cocoslabs Innovation Solutions Private Limited, & 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.
- 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).

Medical devices

- iii. **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 & Isolation Wards.

Masks

- iv. **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.

Diagnostic Kits

- v. **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.

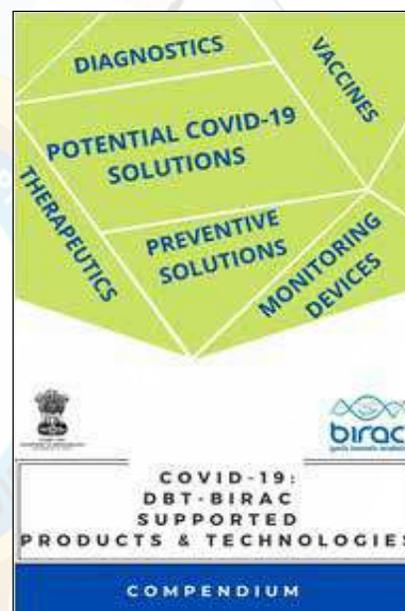
SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

INNOVATION & TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY (DBT)

The DBT and its public sector undertaking Biotechnology Industry Research Assistance Council (BIRAC) have been relentlessly working to address the COVID-19 global healthcare crisis. DBT-BIRAC has prepared a compendium document that highlights DBT and BIRAC's science and technology efforts to fight against the pandemic. This compendium provides an overview of supported products and technologies under various heads: Products in Market, Products to be in market in 3-6 months, COVID-19 research pipeline, and other additional facilitations. DBT and BIRAC are working with the start-ups to scale up their COVID-19 healthcare prevention and treatment solutions. BIRAC-supported 20 start-ups have emerged as potential COVID-19 solution providers and the products are already available in the market to help the masses at large. BIRAC created a provision to fund COVID-19 solutions that are ready for immediate deployment under a 'Fast Track Review Process'. Under this initiative, 6 start-ups have been funded and 2 Co-funding partners selected for in turn funding up to 25 start-ups.

The compendium provides detail of various projects funded under DBT-BIRAC, COVID-19 Research Consortium Call, to support Diagnostics, Vaccines, Novel Therapeutics, Repurposing of Drugs or any other intervention for control of COVID-19. The compendium showcases the various innovations that are available and those that are in the pipeline. It offers a platform to the innovators to get connected with various stakeholders in the Indian healthcare ecosystem to work coherently towards tackling COVID-19 at local as well as national level. The compendium was released on the occasion of National Technology Day on 11th May 2020 and is being updated regularly.



For more information, visit:

https://birac.nic.in/webcontent/Birac_Compndium_2020.pdf

Technologies for Potential COVID-19 Solutions from BIRAC and DBT Autonomous Institutions

Following innovations from BIRAC-supported start-ups have the potential to help combat COVID-19 in different ways. With further support and validation in COVID-19 settings, they might be used as solutions to fight this pandemic.

Innovation (Product/Technology)	Start-Up
AnuPath™: Point-of-Care Hand-Held Multi-Analyte Diagnostic Device	PathShodh Healthcare Pvt. Ltd.
ATOM: Accurate TeleECG On Mobile	Cardea Biomedical Technologies Pvt. Ltd.
AyuSynk: Smart Stethoscope	Ayu Devices Pvt. Ltd.
CRS: Catheter Reprocessing System	Incredible Devices Pvt. Ltd.
Dozee	Turtle Shell Technologies Pvt. Ltd.
Fetal Lite: Fetal Heart Rate Monitor for Women in Labor	SattavaMedTech
Hand-cranked Defibrillator for Sudden Cardiac Arrest	Jeevtronics Pvt. Ltd.
JANITRI	Janitri Innovations
LungIQ: Precision Insights from Lung CTs	Predible Health Pvt. Ltd.
Nano AgCide Technology	WeinnovateBiosolutions Pvt. Ltd.
Nasofilters, NasoMask	Nanoclean Global Pvt. Ltd.
NeoBreathe Easy to Use Pedal-operated Infant Resuscitator	Windmill Health Technologies Pvt. Ltd.
Net4Medix: Telemedicine Platform	Periwinkle Technologies Pvt. Ltd.
Portable Compact Mobile Lab (PCML) and La-bike	Accuster Technologies Pvt. Ltd.
ReMeDi NOVATM Digital Health Solutions	Neurosynaptic Communications Pvt. Ltd.
Specialty Medical Supportive/Palliative Care to Patients at Home	Ubiqare Health Pvt. Ltd.
VapCare: Automated Secretion Management and Oral Hygiene System for Ventilated Patients	Coeo Labs
Nemocare	Nemocare Wellness Pvt. Ltd.
Niramai	Niramai
GOassure™	MicroGO



**SCIENTIFIC ENDEAVOURS IN INDIA:
EMERGENCE TO PANDEMIC**

INNOVATION & TECHNOLOGY

**DEPARTMENT OF SCIENTIFIC &
INDUSTRIAL RESEARCH (DSIR) &
COUNCIL FOR SCIENTIFIC
RESEARCH (CSIR)**

The key to flattening the curve in the number of Coronavirus cases is the detection of the infected at the earliest and isolating them. A combination of digital and molecular surveillance with rapid diagnosis is the need of the hour and CSIR is striving towards that using multiple strategies. CSIR was one of the first institutions to carry out testing in the country. With state-of-the-art genomics and molecular biology laboratories in the CSIR network, it has not only been at the forefront of testing but also developing cost-effective and accurate diagnostic kits for detecting the COVID-19 virus.

CSIR came up with a new, faster, more sensitive and cheaper diagnostic test kit called FELUDA, a CRISPR/Cas-based paper diagnostic kit developed by IGIB. This diagnostic test kit can detect single nucleotide variants in RNA or DNA or more broadly detect any DNA or RNA fragment, without the need for sequencing. RT-Lamp and NGS are also to be added.

An indigenous diagnostic platform, namely Truenat, developed with the support of NMITLI, has been approved for testing of the coronavirus at the national level. It can capture data from the installed machines and feed the central database for surveillance purposes.

Several Indian companies are coming up with new diagnostic kits that need to be validated by the government before accepting them and putting them to use. Some of the CSIR labs are also working as Diagnostics Validation Centres that test and validate the kits.

Developing new drugs against coronavirus may take a few years despite the best efforts from the global scientific community. However, efforts are underway worldwide to fast-track and test the drugs approved or tested for non-coronavirus diseases such as HIV or Ebola. It is this repurposing of drugs that CSIR took up as its drugs vertical against COVID-19. India is also participating in some of the global trials and will also carry out its own clinical trials. CSIR is exploring all possible options ranging from repurposed drugs to new drugs to Ayush products and biological therapeutics including vaccines. It is working on the synthesis of the top 'potential' repurposed drugs. In case India goes for compulsory licensing, the drugs can be quickly launched in the country for patients. For this, CSIR has tied up with top pharmaceutical companies such as Cipla and Cadila.

CSIR has many high-quality engineering labs with the expertise of developing medical devices. NAL, CMERI, CECRI, CSIO and many other labs are working actively in the development of ventilators, disinfection systems, oxygen enrichment units and PPEs. For industrial scale-up, CSIR has partnered with PSUs such as BHEL, BEL, etc.

CSIR is preparing itself to address the unmet need of a large number of hospitals. Its constituent laboratories, namely Central Building Research Institute (CBRI), Roorkee and Structural Engineering Research Centre (SERC), Chennai have the expertise and can undertake the work of transforming existing schools into makeshift hospitals and also set up on-site modular 2- to 4-bed transit hospital facilities as immediate measures. The laboratories also have expertise in setting up pre-engineered buildings as short-term measures. CSIR has also provided some other solutions/products such as waste disposals, dispensers and disinfectants, hand sanitizers, ready-to-eat food and immunity boosting formulations.

CSIR has launched Aarogya Path, a web-based solution for the healthcare supply chain, which provides real-time availability of critical supplies. Aarogya Path would serve manufacturers, suppliers, and customers through the web portal <https://www.aarogyapath.in>. Kisan Sabha App (https://play.google.com/store/apps/details?id=com.SarvodayaVentures.KisanSabha.com&hl=en_IN) has been developed that would connect farmers to supply chain and freight transportation Management System. It aims to provide the most economical and timely logistics support to the farmers and increase their profit margins by minimizing interference of middlemen and directly connecting with the institutional buyers.

Some of the innovations/technologies/products developed are

Rapid and Economical Diagnostics

- 1) Dry Swab-based RNA Extraction Free Direct RT-PCR Diagnostics;
- 2) FnCas9 Editor Linked Uniform Detection Assay (FELUDA);
- 3) IgG/IgM Detection Using a Biolayer Interferometry;
- 4) Micro PCR with Disposable Chip;
- 5) NGS-based High-Through put Diagnostics;
- 6) One-step RT PCR Kit-COVID-19; and
- 7) RT-LAMP Diagnosis of COVID-19.

Development of Repurposed Drugs/New Drugs & Vaccine

- 1) Coronavirus Culture;
- 2) Process Development of Drugs Repurposed for COVID-19;
- 3) Process for Niclosamide;
- 4) Synthetic Process for Camostat Mesylate;
- 5) Repurposing of Colchicine for COVID-19 treatment;
- 6) Repurposing of Umifenovir against COVID-19;
- 7) Process for Tilorone Dihydrochloride (InterferonInducer); and
- 8) Zinc Gluconate Vitamin C Formulation (Zincona-C) for Immunity Improvement.

Hospital Assistive Devices and Personal Protective Equipment (PPE)

Ventilators, Oxygen Concentrators and Other Devices

- 1) Aerosol Canopy for Dental Procedures;
- 2) Bilevel Positive Airway Pressure (BiPAP) System Portable Ventilator;
- 3) Hospital Care Assistive Robotic Device (HCARD);

- 4) Intubation Hood;
- 5) Oxygen Enrichment Unit (OEU) based on Membrane Technology For Oxygen Therapy;
- 6) Pressure Sensor; and
- 7) Respiration Assistance Intervention Device- A Portable Ventilator (Respi-AID).

Personal Protective Equipment

- 1) Coverall Suit and
- 2) Efficient Antimicrobial Materials, Formulations and Coatings, Cotton Fabrics for Reusable PPE (Masks/Gowns).

Masks and Shields

- 1) 3-D-Printed Face Shield;
- 2) 3-D-Printed Face Mask;
- 3) Face Shield;
- 4) High Efficiency Hydrophobic Three-Layered Facemask;
- 5) Membrane-based Face Mask;
- 6) Printable Face Shield to Protect from COVID-19;
- 7) PolyTi:A Biopolymer Coated Medical Grade Mask;
- 8) Reusable Face Mask with Antimicrobial Coating; and
- 9) Reusable Stopgap Face Mask

Makeshift Hospitals

- 1) Karuna Bhawan (Makeshift Hospital for COVID-19);
- 2) Prefab Foldable Modular Structure for Makeshift Transit Hospital for COVID-19: Poli-Tal(M); and
- 3) Temporary and Short-Term Hospital Structures for Rapid Construction.

Waste Disposals

- 1) Flocculant-based Gelation, Solidification, Disinfection System for Medical Waste Disposal and
- 2) Green Dispo (MIDI): Eco-friendly & Energy Efficient Electric Incinerator.

Dispensers and Disinfectants

- 1) Air Sanitizer;
- 2) Disinfectant Spray (Jeev Nasi);
- 3) Electrostatic Disinfection Machine (eSPRAY & Covid-Spray);
- 4) Flomop: Floor Disinfectant;
- 5) Foot-operated Hand Washing System (Hasta-Suraksha);
- 6) Hands-free Hand Sanitization System;
- 7) Hands-free Hand Wash: Foot Controlled Water Tap;
- 8) Hands-free Hand Washing Point-NEERWASH;
- 9) Herbal Soap;
- 10) NEERAKSHA Liquid Disinfectant;
- 11) NEERJANTUK: Hands Free Hand Sanitization Point;
- 12) Scientific Know-how on Ozone-based Air Disinfection for Closed Un-occupied Chambers/ rooms;
- 13) Smart Touch-Free (Palm Safe) & Automatic Hand Sanitizer Dispenser (Indoor & Outdoor);
- 14) Swabee - Floor/kitchen/laptop Electronic Devices Disinfectant; and
- 15) UV-Clean Disinfecting Unit (λ -FLASHBOX).

Hand Sanitizers

- 1) Alcohol-based Hand Sanitizer Gel;
- 2) Alcohol-based Liquid Hand Sanitizer;
- 3) Hand Rub Sanitizer;
- 4) Hand Sanitizer with Enhanced Skin Care; and
- 5) Hand Sanitizer, Liquid Soap & Soap Bar.

Miscellaneous

- 1) Herbal Cough Syrup;
- 2) Insulated Coffin;
- 3) Nasopharyngeal Swabs;
- 4) Sustained Release Long Acting Steam Inhalation Drops (NiiSTEAM);
- 5) Trikatu Syrup;
- 6) CIM Paushak-Rasayan-based Awaleh;
- 7) CIM Phal-Se-Nutritive granules;
- 8) Iron and Zinc Enriched Spirulina (Nut and Chocolate Bars);
- 9) Multigrain Protein Mix;
- 10) Nutra Chikki with added Spirulina;
- 11) Nutri Fruit-Bars enriched with Vitamin C and Zinc (Mango and Mixed fruit bars);
- 12) Protein & Fiber Enriched Cereal Bars; and
- 13) Ready-to-Eat Foods for Ethnic Himachali Cuisines.

Supply Chain & Logistics Support System

- 1) Aarogya Path – Healthcare Supply Chain Solution;
- 2) Kisan Sabha; and
- 3) Short-term Prediction of COVID-19 Positive Cases in India.

For more information:

<https://www.csir.res.in/sites/default/files/CSIR%20Technologies%20for%20COVID-19%20Mitigation.pdf>

NRDC Funds COVID-19 Technologies for Scaling up and Validation

The National Research Development Corporation (NRDC), an enterprise under DSIR, Ministry of Science and Technology, Govt of India, invited proposals from the innovators under its DSIR grants-in-aid promotional programme for development of technologies for commercialization (PDTC) for Up-scaling the COVID-19 related technologies. The financial support is given for development of COVID-19 technologies in the area of tracking, testing & treatment, covering process scale up, pilot plant studies, validation/authentication of the product, registration of the product with regulatory authorities, conducting field trials, generation of toxicology data, bridging the gap between the lab scale development and industrial requirement, so that commercial production and marketing of product become successful.

Against the advertisement, 65 proposals were received seeking funding from NRDC. A three-member external Technology Expert Committee was constituted and they have recommended 16 projects for funding as they are technically sound and relevant. The projects funded are in the area of Testing, Tracing and Treatment of COVID-19 and the technologies selected for support are in the area of Test Kits, Sanitizers, Ventilators, PPEs, Masks, and COVID-19 hospital effluents treatment. Some of the Institutions and Companies selected include:

- IIT Delhi;
- Sahajanand Technologies Pvt. Ltd, Surat;
- IDEMI, Mumbai;

- INM Indian Navy, Mumbai;
- Omix Research & Diagnostics Laboratories, Bangalore;
- VBRI Innovation Pvt. Ltd, New Delhi;
- FFDC, Kannauj;
- CIBART, New Delhi;
- Rudrani Hospitality Solutions, Delhi; and
- LN Inditech Services Pvt. Ltd, Bhubhaneswar;
- Several other academic institutions and individual innovators who are working with NRDC apart from above mentioned names could be included in the list.

For more information:

<https://pib.gov.in/PressReleaseDetail.aspx?PRID=1639289>

NRDC Transfers Two COVID-19 Technologies Developed by S.N. Bose National Centre for Basic Sciences

National Research Development Corporation (NRDC), an Enterprise of DSIR, Ministry of Science and Technology, Government of India has entered into an agreement with M/s Paulmech Infrastructure Pvt Ltd, Kolkata to transfer two COVID-19 control technologies developed by S.N. Bose National Centre For Basic Sciences (SNBNCBS), Kolkata an Autonomous Research Institute under the Department of Science and Technology, Government of India. The two technologies developed by SNBNCBS and transferred by NRDC are

- An Active Respirator with Attached Exhalation Valve and Suspended Particulate Matter Filter for Comfortable and Hygienic Breathing and
- Long-Lasting Nano-sanitiser with a Dispensing Antimicrobial Layer.

For more information, visit

http://nrdcindia.com/uploads/press/1595227496Published_NRDC_Transfers_Two_COVID-19.pdf

NRDC licenses manufacturing know-how of Navrakshak to MSMEs

The National Research Development Corporation (NRDC) has licensed the manufacturing know-how of Nav Rakshak, a Personal Protective Equipment (PPE) Suit, to five companies in the Ministry of Micro, Small, and Medium Enterprises (MSME) sector. The move is expected to increase the production of the same to meet the ongoing country-wide demand of quality PPE kits.

Nav Rakshak is cost-effective as it does not require any major capital investment and can be adopted even by gown manufacturing units using basic stitching expertise. The technology and quality of fabric is so superior that there is no need of sealing around the seam of the PPE suit, thus eliminating the need of importing costly sealing machines and tapes. The PPE fabric does not require any lamination with polymer or plastic-like film. This enables the PPE to permeate heat and moisture from the skin of the user. It gives protection but does not compromise on comfort. This uniqueness of the PPE makes it way different from the existing PPEs being used.

Nav Rakshak has been designed by a Naval doctor incorporating personal experience in using the PPE for the comfort and protection of the doctors. The enhanced breathability factor in the PPE suit makes it an attractive proposition considering that frontline health workers use it for long hours.

For more information:

<https://vigyanprasar.gov.in/isw/NRDC-licenses-manufacturing-know-how-of-NavRakshak-to-MSMEs.html>

**SCIENTIFIC ENDEAVOURS IN INDIA:
EMERGENCE TO PANDEMIC**

INNOVATION & TECHNOLOGY
**DEFENCE RESEARCH AND
DEVELOPMENT ORGANISATION (DRDO)**

The immediate war with COVID-19 can be won with the physical equipment besides the scientific facts backing them with the researches done earlier. Research and Technology represent a successively larger category of activities which are highly distinct yet interdependent. Scientific research contributes to the innovation and development of technology through the new knowledge which serves as a direct source of ideas for new technological possibilities. This acts as a source of tools and techniques for developing more efficient engineering design and a knowledge base for evaluation of feasibility of the designs, developing research instrumentation, laboratory techniques and analytical methods used in research. It eventually finds its way into design or industrial practices, often through intermediate disciplines and many other ways. Any technology developed always has its traces back from some kind of research and studies.



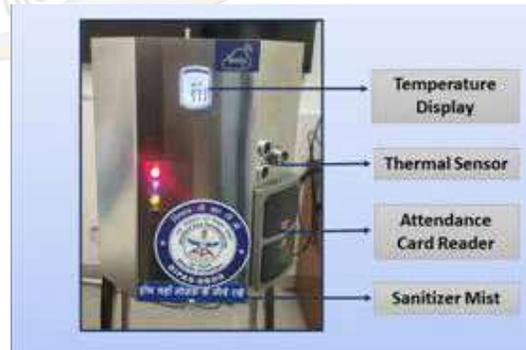
COVID-19 Sample Collection Kiosk (COVSACK)



DRDO Low Cost Portable Ventilator (DEVEN)



Defence Research Ultraviolet Sanitizer (DRUVS)



Sanitizer With Attendance Gear And Temperature Monitoring (SWAGATAM)

Information in this section has been compiled to provide a comprehensive viewpoint on the overall effort of DRDO in the area/field of innovation and technologies. DRDO Laboratories working under life sciences cluster and many other labs with the possibility of producing spin-off technologies geared to support national mission to combat COVID-19. The technologies and products have been developed to support the national warriors fighting the most important war at this point of time. Most of the technologies are for safeguarding them and prevent the spread of the virus. Following are the enlisted technologies and innovative ideas converting into products contributed by various laboratories of DRDO:



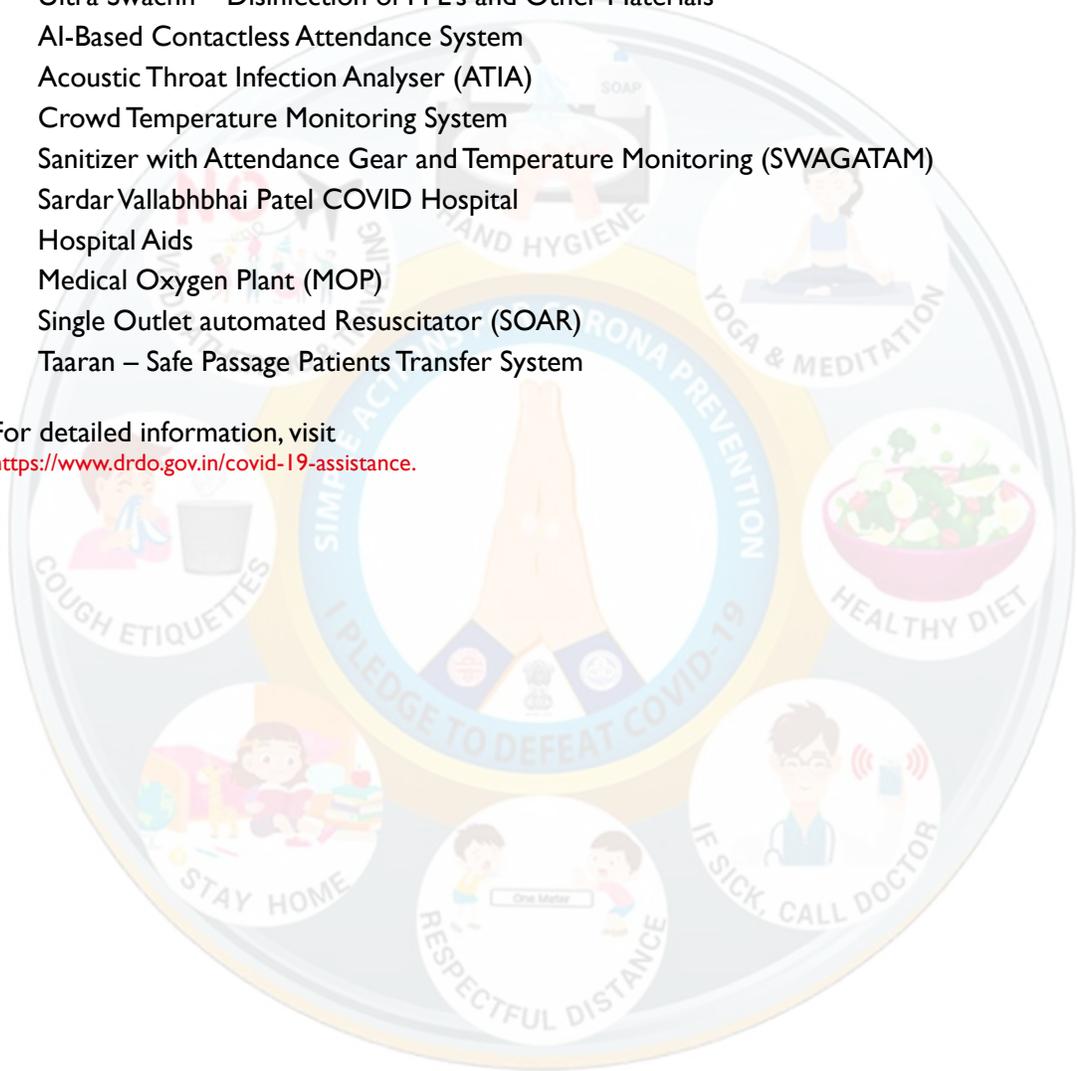
MEDIDOOT – Medical Trolley

- Hand & Surface Sanitizer
- Herbal Sanitizer
- Herbal Sanitizing Wipes, Hand Towels and Herbal Shwas
- Advanced Face Masks
- Advanced Face Masks with Nano-Web (Bio-Protective)
- Advanced Face Masks with Melt Brown Filter (Bio-Protective)
- N-95 Reusable Masks
 - Personal Protective Equipment
 - Personal Protective Equipment (PPE) Type A
 - Personal Protective Equipment (PPE) Type B
 - Personal Protective Equipment (PPE) Type C
 - Two Piece Coverall
 - Full Face Shield
 - Enclosure for Intubation Procedure – Aerosol Containment Box
- Sample Testing for COVID-19
 - Covid Sample Testing facilities
 - Synthetic blood penetration test facility
 - Face Mask Testing
 - Sanitizer Testing
- Hands-Free Sanitization Units
- Automatic Mist Based Hand Sanitiser Dispensing Unit
- Contactless Sanitizer Dispensing Unit
- Sample Collection Enclosures
 - Covid-19 Sample Collection Kiosk (COVSack)
 - Walk-In Swab Collection Kiosk (WISK)
 - Versatile Body Sanitization Kiosk (VerBSak)
- Body Temperature Probe (Contact Type)
- Body Temperature Probe (Non - Contact Type)
- Ventilators
 - Ventilator
 - DRDO Low Cost Portable Ventilator (DEVEN)

- Personnel, Vehicle and Area Sanitization Equipment
- Personnel Sanitization Enclosure (PSE)
- Personnel Sanitization Enclosure (Fog Based)
- Portable Backpack Area Sanitization Equipment
- Trolley Mounted Large Area Sanitization Equipment
- Vehicle Sanitization Enclosure
- Vehicle Sanitization System (Fog Based)
- Mobile Area Sanitization System
- LMV Mounted Area Sanitization Unit
- Shoe and Driveway Sanitizer
- Shoe and Driverway sanitizer – Benzalkonium Chloride Based
- Fogg Sanitizer – Disinfection of Room/Chamber
- Personnel Sanitization Enabler (PerSan)
- Other Sanitization Accessories
- Evaporating Fogger for Sanitization
- UV Based Sanitization Equipment
- UV Sanitization Box and Hand-Held UV Device
- Defence Research Ultraviolet Sanitizer (DRUVS)
- UV Sanitization Vertical Box for Masks
- Automated Luggage Disinfector Using UV-bath
- Automated System for Decontamination of N95 Facemasks
- UV Blaster – Area UV Disinfection System
- Notesclean
- Portable UVC Killer
- UVC Based Sanitization Enclosure
- Paper Disinfector
- Germiklean- Dry Heat Sanitization System
- Anywhere Erectable Isolation Shelters
 - Standalone Shelter
- Medical Examination Shelter with Green Power Source
- Two Bed Quarantine Module
- Four Beds Quarantine Module
- Inflatable Shelter Module
- Integrated Medical Complex
- Negative Pressure Inflatable Isolation Shelter for Ten Occupants
- Packed Food Technology
- Containerised Test Lab module
 - Mobile Virology Research and Diagnostics Laboratory (MVRDL)
- Parakh: Mobile BSL 3 Laboratory for Covid Samples Testing
- Containerized Test Module
- Multi patient Ventilation (MPV) Kit
- Mobile App for Quarantine Tracking
 - Samparc
- Kavasam
- Suraksha Kawach – Custom Designed IoT Device

- Video Conferencing Solutions
 - Narad
- Sammukh - DRDO Video Conferencing Solution on Internet
- Robots for Medical Use
 - Sewak - DRDO Robot For Keeping Hospital Staff Safe
- Medidoot – Medical Trolley
- Atulya – Microwave Sterilization for Disinfection of CORONA Virus
- Multipurpose Door Opener Tool
- Drone Based Surveillance System
- Ultra Swachh – Disinfection of PPE's and Other Materials
- AI-Based Contactless Attendance System
- Acoustic Throat Infection Analyser (ATIA)
- Crowd Temperature Monitoring System
- Sanitizer with Attendance Gear and Temperature Monitoring (SWAGATAM)
- Sardar Vallabhbhai Patel COVID Hospital
- Hospital Aids
- Medical Oxygen Plant (MOP)
- Single Outlet automated Resuscitator (SOAR)
- Taaran – Safe Passage Patients Transfer System

For detailed information, visit
<https://www.drdo.gov.in/covid-19-assistance>.



**SCIENTIFIC ENDEAVOURS IN INDIA:
EMERGENCE TO PANDEMIC**

INNOVATION & TECHNOLOGY

**MINISTRY OF ELECTRONICS AND
INFORMATION TECHNOLOGY (MEITY)**

The pandemic had forced the whole world to relay and work on-line forbidding any physical communication or information transfer. This had increased the need to innovate and find more user-friendly and affordable technological solutions to the everyday problems the country were facing. The list here provides a glimpse into the ICT and other technological solutions provided by the Ministry of Electronics and Information Technology (MeitY) for combating the issues faced at various organizational, governmental, and citizen level. Another list highlights the efforts made by National Informatics Centre (NIC) to combat the spread of the virus including the state-level initiatives. The following list will give a detailed view into the technological innovations and discoveries initiated by MeitY since the onset of pandemic:

1. Development and technology transfer of Polymer swab for testing of COVID-19;
2. Synthesis of nano-particles and its coatings on cotton/polyester fibres for having antiviral and antibacterial properties;
3. Cost-effective portable plasmonic sensor for random testing of novel coronavirus at community level;
4. Portable molecular diagnostics test instruments for COVID-19;
5. Oxygen gas sensors: Scale up and product delivery for ventilator application;
6. Strip-based handheld electrochemical point-of-care testing for COVID-19;
7. Product development, field trials, and TOT of indigenous RT-PCR device;
8. Drug repurposing studies on COVID-19 proteins;
9. SAMHAR-COVID19 – Supercomputing using AI, ML, Healthcare Analytics-based research for combating COVID-19;
10. Computational Drug Repurposing Studies on SARS-CoV-2 Proteins;
11. NAADI Platform – National Analytical Platform for Dealing with Intelligent Tracing, Tracking and Containment of COVID-19 Pandemic along with 2 mobile apps;
12. Digital thermometer for screening and patient temperature monitoring for COVID-19;
13. MeitY develops an online registration framework portal, a digital India initiative;
14. NIC develops two Mobile Apps: Rapid Antibody Test of India (RATI) and RT-PCR Test of India.

For more information, visit

<https://www.meity.gov.in/emcd-effort-towards-building-products-counteracting-covid-19-pandemic>.

ICT solutions on COVID-19 by NIC:

S No	Title	Brief Details
1	Arogya Darshak Map	This GIS-based Containment Zone and Hospital Information system will provide detailed information like active patients, population size, samples collected etc., in Containment Zones, in themap of Nandurbar District. The Map also displays information related to hospital and its facilities for COVID-19 in the district.
2	COVID-19 Dashboard	Total COVID-19 cases in Nandurbar district and their analysis has been provided in the dashboard.
3	Behaviour Change Management App	This app is a training platform for citizens and all cadres of Meghalaya, on COVID-19 Pandemic. Different training modules are available at one place under different categories such as farmers, drivers, health workers, etc.
4	Real-Time Polymerase Chain Reaction (RTPCR) Mobile App	NIC Himachal Pradesh has developed a dedicated Real-Time Polymerase Chain Reaction (RTPCR) Mobile App, for COVID-19 sample collection centres/labs spread across the country. This app is used to capture data at the point of sample collection, to minimize error in reporting real-time data to the Government authorities.
5	NIC's eHospital software is being used in 10,000-bedded Sardar Patel COVID Care Centre & Hospital in Delhi	eHospital software has been customized to cater to the needs of 10,000-bedded Sardar Patel COVID Care Centre and Hospital (SPCCCH) in Chhatarpur, Delhi. It will facilitate admission, daily monitoring of COVID-19 patients, inventory of items and dashboard. It has been integrated with ICMR and COVID-19 India Portal for the purpose of patient status updation.
6	eOffice usage in Punjab during COVID-19	NIC's eOffice is being extensively used for seamless working of State Government in Punjab during the COVID-19 lockdown. NIC is providing comprehensive support for eOffice usage to various State Govt. Departments. Around 20 new Departments have on-boarded with 10 days training sessions for over 4000 employees.
7	West Bengal State Emergency Relief Fund	To help the Government of West Bengal combat COVID-19, NIC developed and launched an online portal for 'West Bengal State Emergency Relief Fund'. Online Payments can be made on this portal via UPI, Net Banking, Credit/Debit Card, NEFT, RTGS, Cheque & DD.
8	Passenger Registration & Management System (PRMS) at Jammu Railway Station	In order to keep systematic records of all passengers arriving at Jammu Railway Station and to inform them about their COVID-19 test results, IT-enabled solutions and mobile applications have been launched in Jammu. These applications are downloaded on handheld gadgets and mobile phones enabling officials to do their job at ease and with precision.
9	'e-Market Kurukshetra' Mobile App	NIC Kurukshetra developed 'e-Market Kurukshetra' Mobile App that provides a common platform for service provider & citizens to meet their needs for home delivery of essential items & services in the region amid COVID-19 lockdown.

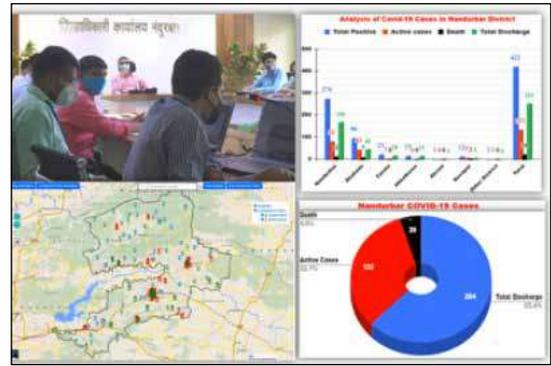
10	NIC's technology-enabled e-learning solutions across several States to ensure continuity of School Academic Curriculum during COVID-19	NIC is providing various technology-enabled e-learning solutions across several States such as Chhattisgarh, Madhya Pradesh, West Bengal, Rajasthan, Tamil Nadu etc. These solutions are not only supporting the sustenance of School Academic Curriculum during COVID-19-induced lockdown but also making online classes more engrossing for kids.
11	PAiSA Portal	NIC developed a Management Information System (MIS) for National Urban Livelihoods Mission (NULM) integrated with 'PAiSA Portal' which is an online payment gateway for transferring funds to Urban Poor during COVID-19
12	COVID-19 Quarantine Monitoring & Tracking System	NIC West Bengal developed 'COVID-19 Quarantine Monitoring & Tracking System' Web & Mobile application which is implemented in the State. It helps in real-time monitoring & tracing of the COVID-19 quarantined/suspected/positive cases with their admission/discharge details.
13	COVID-19 Management Portal	NIC developed the 'COVID-19 Management Portal' for management of Quarantined persons at Quarantine Centres by the Delhi Govt. This Portal provides features like Database of Quarantined Person, Unique Case ID, Search based on Case ID etc.
14	Open Government Data (OGD) Platform	Open Government Data (OGD) Platform India has created a live dashboard on COVID-19 with datasets sourced from Ministry of Health and Family Welfare. Infographics, data-visualization, analytics, Health Infrastructure open data, etc. are also available in the dashboard page.
15	Medical Oxygen Monitoring System	NIC Nagpur has developed 'Medical Oxygen Monitoring System' to monitor inventory of liquid oxygen manufactured & stored at State/District level in the country. This system ensures seamless supply of oxygen to Government & other hospitals identified for treatment of COVID-19.
16	COVID-19 Test Sample Management System	NIC Anantnag developed & implemented 'COVID-19 Test Sample Mgmt. System', to monitor the samples sent to labs in UT of J&K. This Portal also enables Medical Authorities & Dist. Administration to monitor collection & testing reports in real time.
17	Corona Sample Collection Monitoring System	NIC Delhi developed & implemented 'Corona Sample Collection Monitoring System', an online application to monitor Corona samples & reports collected from COVID Care Centres, COVID Testing/Health Centres, Govt/Pvt. Hospitals & Containment Zone etc.
18	GIS-based COVID-19 Care	NIC developed 'GIS-based COVID-19 Care' module of OneMap Greater Noida Portal which is incorporated with Total COVID-19 Hotspots & Hotspot Sectors Buttons, providing varied information (1km BufferZone) to demarcate the locations for containment.
19	NIC developed MoHFW portal, serving as official source of information on COVID-19 pandemic in India	NIC developed & maintained Ministry of Health and Family Welfare portal, which is serving as primary & official source of information on COVID-19 pandemic, updated statistics & insightful content on public health.

20	'COVID Care Kerala' App	The app has features like Counselling Service & Geo-tagging for Quarantined persons & COVID-19-affected patients, Contacts for Food & Grocery supply & Community Kitchen etc.
21	'Quaiso Tracker' Mobile App	NIC Dhamtari has developed 'Quaiso Tracker' Mobile App for surveillance of persons in quarantine/isolation (Foreigners/Other State migrants) in Chhattisgarh. This App uses local Government directory for rural/urban mapping, with real-time locations tracking.
22	Geo-Fencing App 'Corona Surveillance' in J&K	National Informatics Centre (NIC) J&K developed Geo-Fencing App 'Corona Surveillance' that tracks the location of the quarantined persons & alerts the Rapid Response Teams to take necessary action if the quarantined persons move away from their designated location/home.
23	'Corona Virus Alert Assam (COVAAS)' Mobile App	Hon'ble Chief Minister, Assam launched 'Corona Virus Alert Assam (COVAAS) Mobile App developed by National Informatics Centre (NIC) Assam. This app is highly scalable & a one-stop solution providing services & information on the COVID-19 pandemic for residents of the State.
24	'VANI-COVID19', a multilingual Chatbot	NIC Meghalaya, in collaboration with Artificial Intelligence Resource Division, NIC, has developed 'VANI-COVID19', a multilingual Chatbot to address COVID-19-related queries for the people of Meghalaya, in English, Khasi & Garo languages.
25	Corona Foot Warriors, Delhi	NIC Delhi developed Web Application, 'Corona Foot Warriors, Delhi' for Corona Foot Warriors Containment & Surveillance Team of the Revenue Department Delhi Government that helps grassroot-level intervention. It facilitates effective monitoring at various levels, user management and filing of daily reports after visits to field areas by the team.
26	COVID-19 Tracking & Monitoring System for Uttarakhand	National Informatics Centre Uttarakhand developed 'COVID-19 Tracking & Monitoring System' for Uttarakhand State Disaster Management Authority using NIC's Multilayer Geographic Information System (GIS) Platform Services – Bharatmaps. It provides statistics on COVID-19 situation in the state & basic details, including location of people in quarantine.
27	CollabCAD software developed by NIC	NIC designed & developed indigenous Computer-aided Designing (CAD) software 'CollabCAD' & 'e-CollabCAD Viewer'-the 3D Web Viewer services released for Atal Tinkering Labs (ATL) under the Atal Innovation Mission (AIM) by NITI Aayog, GOI, for the benefit of students during 'Stay At Home' amid COVID-19. This software provides a great platform to students of Atal Tinkering Labs (ATLs) across the country to create and modify 3D designs with free flow of creativity and imagination. This software would also enable students to create data across the network and concurrently access the same design data for storage and visualization.

28	COVID Complaint Management System via 1950 Helpline	<p>NNIC Ranchi developed 'COVID Complaint Management System via 1950 Helpline' that captures grievances related to COVID-19 suspects, test centres, shelter homes, law & order, PDS shop & LPG delivery etc.</p> <p>The District COVID-19 Helpline is helping citizens by providing information through 1950 Helpline and the COVID Complaint Management System is capturing grievances through the web-based portal. The daily status of grievance disposal is reflected on the dashboard.</p>
29	COVID-19 Suspects management system in Jodhpur	'COVID-19 Suspects Management System' maintains patient's contact details and can be used for monitoring at the District level, hospital level and the various administrative levels by the authorities.
30	COVID-19 Quarantine Tracker mobile App in Udaipur	<p>National Informatics Centre (NIC) Rajasthan developed COVID-19 Quarantine Tracker mobile App implemented in Udaipur to track the persons who have been quarantined & advised isolation.</p> <p>This app provides a monitoring mechanism to ensure that the person doesn't move to places during quarantine period.</p>
31	'COVID Suraksha', a Suite of Android Mobile & Web-based application	<p>Hon'ble CM of Assam, launched 'COVID Suraksha', a Suite of Android Mobile & Web-based application, developed by National Informatics Centre (NIC), in Hojai.</p> <p>It helps to monitor visits of ASHA workers to home quarantined persons & also ensure their regular medical check-ups, via QR code scan. The concerned Officials of the District Administration can view the visit status of the ASHA workers in a web dashboard. The application will be replicated in all the districts.</p>
32	Web portal on COVID-19 for Govt. of Haryana, providing one-stop information & links on COVID-19-related informations	<p>NIC developed & hosted a dedicated web portal on COVID-19 for Govt. of Haryana, providing one-stop information & links on COVID-19-related advisories, instructions, notifications, Govt. Orders & Awareness material issued by the Centre/State Govt.</p> <p>The portal offers services like Helpline nos. for Health, Ration & Financial Assistance, Curfew pass, Registration/Search of unorganized sector migrants, people in relief camps and Registration of Volunteers to support State & District Admin to tackle COVID-19.</p>
33	Covid-19 Jagratha	<p>'Covid-19 Jagratha' is a comprehensive Information & Management portal for surveillance, care & support for the people affected/quarantined by COVID-19 in Kerala.</p> <p>This portal is developed by NIC and is implemented in all 14 Districts of the State.</p> <p>The portal is a one-stop platform to avail information on COVID-19 with daily monitoring & recording of data and generating surveillance reports also. People can apply for medical-aids, ambulance, vehicle permits, volunteers pass & clinical categorization etc.</p>
34	AarogyaSetu App	AarogyaSetu is now a popularly installed app for detecting & alerting risk perception in respect of COVID-19 to aid the COVID-19 efforts of the Government. The App works based on contact tracing method and helps the Government in identifying, monitoring and mitigating the spread of COVID-19 across the country.



AarogyaSetu App



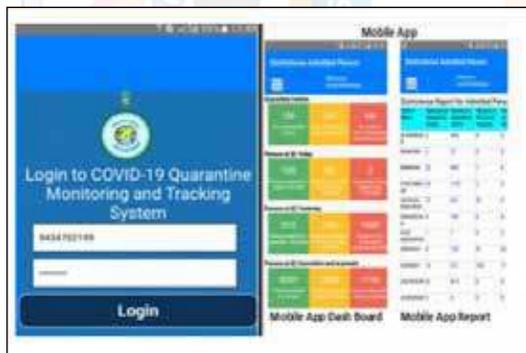
ArogyaDarshak



Real-Time Polymerase Chain Reaction (RT-PCR) Mobile App



'e-Market Kurukshetra' Mobile App



COVID-19 Quarantine Monitoring & Tracking System



COVID-19 Management Portal

For more information, visit:
<https://www.nic.in/whats-new/>

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE AND SOCIETY

DEPARTMENT OF SCIENCE & TECHNOLOGY (DST)

The Science for Equity Empowerment and Development (SEED) Division of the Department of Science and Technology (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.

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.



Initiatives by Survey of India

The mobile application SAHYOG as well as the web portal (<https://indiamaps.gov.in/soiapp/>) prepared and managed by the Survey of India (Sol) 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.

Hand sanitizer prepared by ARCI for on duty police personnel during COVID-19 crisis

International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad, 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 liters of sanitizer.



The team who had made 40 liters hand sanitizer within a few hours

Dr R Vijay handing over the hand sanitizer bottles made at ARCI to ShriSunpreet Singh, DCP, RachakondaCommissionerate

COVID-19 Interventions through S&T Knowledge Organizations as Social Scientific Responsibility

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.

Preparation and Distribution of Sanitizer among Community

- Against several odds Chandigarh University, took initiative to deliver 500L sanitizer and 500 facemasks to All India Institute of Medical Sciences (AIIMS), New Delhi for their





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

security staff and Sulabh workers, 500L sanitizer to Safdarjung Hospital, New Delhi for their medical staff. 200 L sanitizer was delivered to Senior Superintendent of Police and Director General of Police, Haryana for their Police Officials respectively.

- 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 liters 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 सॉपी टेक्नोलॉजी
 कोविड-19 के संचरण को रोकने हेतु हैंड सैनिटाइजर की मांग में जबरदस्त इजाजत हुआ है। एनबीआरआई द्वारा तैयार हैंड सैनिटाइजर की प्रौद्योगिकी एक कंपनी को सौंपी गई। टेक्नोलॉजी विकसित करने वाले कामोद्योगोसी डिवीजन के सीनियर प्रोसिपल साइंटिस्ट डॉ. शरद शंकर ने बताया कि यह टेक्नोलॉजी कोविड-19 के संचरण 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 न आए। एनबीआरआई सीएसआइआर सोशल रिस्पॉन्सिबिलिटी के महत्त्व आवश्यक संस्थाओं में लगे सरकारी कर्मचारियों को भी सैनिटाइजर निशुल्क उपलब्ध करा रहा है।

Distribution of sanitizer in Lucknow, and technology transfer to Pvt. company

- Although, there are only two confirmed cases of COVID-19 infection in Manipur and Tripura respectively, 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.

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. These institutes have also promoted use of *AarogyaSetu* App and *AyurvedicUpay* 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 facilitated mask making by women SHGs in villages near Mathura

- 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.



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

- 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. These WhatsApp groups includes Sarpanch, Gramsevak, Tahsildar, Grampanchayat members, the youth of villages, farmers, Krishi Vigyan Kendra district officers, scientists and technicians etc.

Protection of Pregnant Women During COVID-19

Department of Obstetrics & Gynecology, 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 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 commencing 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

Innovating for Immediate Need during COVID-19

- 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, 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.



Media coverage of herbal decongestion spray

- DST has established a mechanical fabrication and 3D printing facility at Karpagam Academy of Higher Education (KAHE), Coimbatore, Tamilnadu, 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.
- A portable full-body disinfection chamber has been developed for disinfection of personnel in the areas of controlled entry & 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 secs
 - Roof-mounted and bottom tanks with 500 liters capacity.
 - Disinfection of 500 people in single fill of disinfectant.



Portable full-body disinfection chamber developed by KAHE

- 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 pedal fixed hands-free dispenser for hands sanitization without physically touching the water tap and sanitiser dispenser, thereby making it safe for usage at common places.



Mechanical pedal fixed hand free dispenser for hands sanitization by KAHE

- Apart from project related activities scientific community took the responsibility to create awareness in their native villages. Dr K.P.Sridhar, KAHE, Coimbatore, Tamilnadu 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. This reflects the social responsibility of the scientific fraternity.

- The scientists are not only innovating but also contributing their services as warriors for testing the patients. In this endeavor, the project staff at Baba Farid University of Health Sciences, Faridkot, Punjab has been diverted to COVID-19 testing lab setup in the organization.



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

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

Health and Hygiene

- In view of social distancing and various psychosocial responses to pandemic by community, AIIMS, New Delhi in partnership with Mental Health Foundation of India (MHFI) are planning to develop Psychological First Aid (PFA) program for COVID-19 and similar pandemic/epidemic as an extended part of its unique initiative at Tihar jail. 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.
- 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.
- IIT-Delhi already working for 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). O_3 makes a potent disinfectant with its strong oxidation ability and absence of harmful residue after treatment makes it ideal disinfecting agent.

Livelihood restoring activities

- As agriculture is 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.

COVID – 19: RESILIENCE & CAPACITY BUILDING OF WOMEN AT GRASSROOTS THROUGH WOMEN TECHNOLOGY PARKS

The Science for Equity Empowerment and Development (SEED) Division of the Department of Science and Technology (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.

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

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 Technology Park (RWTP) at Krishi Vigyan Kendra (KVK), Sitapur

The RWTP at KVK Sitapur has trained farm women on “How to make hand sanitizer at home” using locally available materials like neem leaves, alum, camphor, aloe vera, tulsi leaves etc. and 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 in 16 villages for sensitizing rural families about social distancing during household/ farm works, proper food and nutrition, nutritional garden, cleanliness and washing of hands using ICT measures. Video messages through mobile network were circulated on preparation of face mask using old clothes by hand.



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

Rural Women Technology Park at Basani, Varanasi

Rural Women Technology Park 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. WTP gave online training to create the digital designs and generating finished products.



Glimpses of activities of RWTP at Basani, Varanasi

Women Technology Park 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.

Sri Padmavati Mahila Vishwa Vidyalayam (SPMVV) and Rural Women Technology Park

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 RWTP, SPMVV distributed daily necessities of vegetables including onion, tomatoes, cabbage, lemon, garlic etc., in the adopted village of Chitanyapuram, Karakambadipanchayat of Reniguntamandal.

Sona College of Technology, Salem along with its Rural Women Technology Park

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.



Women at RWTP stitching masks on special sewing machines

Rural Women Technology Park, Malabar Social Service Society (MASSS), Kannur

This Down south 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 to 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

Rural Women Technology Park at PSGR Krishnammal College, Annur

The RWTP and the college adopted many villages within Annur area to sensitize people about COVID-19. 75 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 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. Students counselling cells created You Tube links with films on, Stress counselling, Brain Dance – Mind Relaxation, Physical and Psychological Immunity, 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. 500 masks were prepared and distributed among villagers as a result of online training of volunteers.

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

PSCST encouraged a group of women in village GugwaalHaar 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.

COVID-19 Crisis: Direct Interventions through S&T-based Voluntary Organizations

Several S&T-based voluntary organizations working with SEED Division; across the country including those through grant-in aid long term core support towards addressing livelihood challenges have come forward to contribute towards this national crisis. They started responding on day to day basis with their community based management plan to adopt the basic preventive measure (human to human transmission), production and distribution of health and hygiene related products such as hand sanitizers (alcohol based), homemade mask (2-3 layer), hand wash, face shields, and liquid disinfectant etc. as per prevailing standards. These basic actions not only ensure livelihoods security but also take care of the health care needs of the community in inclusive manner. Besides, these people centric organizations are also making efforts to address urgent requirements of food, nutrition, livelihood, and animal care, which needs to be assured in time of lockdown, when supply from outside is cut off due to limited transport and communication facilities. In such an endeavour, these S&T led voluntary organizations delivered immediately the following interventions.

Personal Protective Equipment (PPE) and Protective Measures (MGS)

COVID-19 pandemic has resulted, 17265 infected cases and 543 reported death across India. Currently, there no available vaccine and treatment drug, therefore, the only way to protect is infection prevention through social distancing and control measures such as hand hygiene, PPE (gloves, face masks, face protection shields, rubber boots and head covers) and effective management of waste. Our voluntary organizations showcased their S&T competencies and intervened to the immediate need of the society by preparing hand sanitizers as per the WHO guidelines, face masks as per the guidelines issued by the Principal Scientific Advisor (PSA), Goggles and faceshields using open source designs in last 15 days.

Society for Economic & Social Studies (SESS), Delhi currently is engaged in sanitizer manufacturing in compliance with World Health Organization (WHO) standards. SESS has developed a Sanitization Chamber/Booth to disinfect one person from head to foot using Hydrogen Peroxide spray while entering or exiting hospitals and/or any other health, quarantine facility. Prototype has already been developed/field tested and plans for commercial production as micro enterprise are underway. SESS has also undertaken home-scale or small-group production of simple 2- or 3-ply masks with quality control by engaging SHGs following the protocol recommended by Principal Scientific Advisor (PSA).

These SHGs have prepared 10,000 masks and efforts are underway to develop linkages with State Rural Livelihood Mission, National Bank for Agriculture and Rural Development (NABARD), Uttarakhand State Council for S&T (UCOST) and other State Government agencies to explore possibility of procurement from SHGs promoted by SESS. SESS is already manufacturing 100% natural Liquid Hand-wash (USFDA specifications) with anti-viral properties using local Ritha (*Sapindus mukorossi*), a technology developed under Core Support programme of SEED, DST. Natural liquid Hand-Wash packed in 500ml bottle is now being promoted for use at the community level in leading to alternative source of livelihoods for SHGs and health benefits to people at large.

Although, there are only two reported cases of corona virus infection in Manipur, Ethno-Medicinal Research Centre at Foundation for Environment & Economic Development Services (FEEDS), Hengbung, Manipur has taken up the responsibility towards containing the spread of the disease by creating awareness related to health and hygiene practices. It started making sanitizer as per WHO guideline using 96% ethanol (833.3 mL/L), 3% Hydrogen Peroxide (41.7 mL/L), 98% glycerol (14.5 mL/L) and extract of *Artemisia nilagirica* and *citrinolla* essential oil for its antimicrobial property in its lab for distribution. The alcohol extract of *Artemisia nilagirica* renders natural colour and essence in addition to anti-microbial and anti-allergic properties. Fifteen hundred litres of prepared sanitizer (100ml bottles) was distributed across several villages of Manipur. It also facilitated the availability of liquid soap for hand wash purpose in nearby villages and prepared soap using glycerine (200ml/l), coconut oil (250ml/l), distilled water, and Potassium Hydroxide (25ml/l).



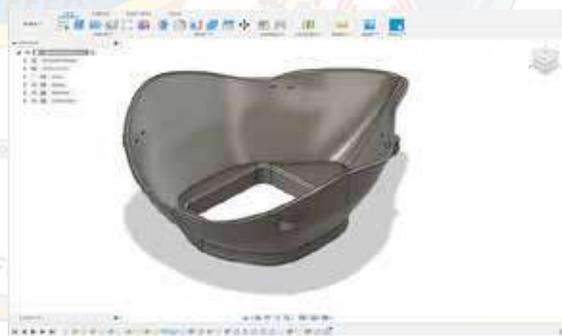
Preparation of ethanol based hand rub sanitizer at Ethno Medicinal Research Centre, FEEDS, Manipur (Core Group, SEED, DST)

Hand sanitizer production by FEEDS, Manipur

Barefoot College, Tilonia, Rajasthan immediately initiated making facemasks for the locals using double layered cotton cloth material and distributed to nearby villages of Tilonia as Rajasthan was at high risk due large number of COVID-19 cases reported. It plans to prepare 200,000 masks for use by frontline health workers and at community level. The college used technology intervention in their Fab Lab for making 3D printed masks for mass production. So far, 50 pieces of 3D mask have been designed, and efforts are also being made to make and supply alcohol based hand sanitizer (150 ml bottle) for community use.



Two ply mask by Barefoot College



The 3D mask by Barefoot College

In order to take care of the immediate food and health care requirement of a basic kit containing food grains, facemask, hand sanitizer and basic awareness information in their local language, was distributed for 1000 underprivileged families in and around Tilonia.

Sai Institute of Rural Development, Varanasi is working with Zardozi Cluster, has taken initiative by involving women beneficiaries to manufacture and distribute face mask, hand gloves, and to make available sanitizer/hand wash and food packets to community including migrant labours,

bus drivers, policeman, and women in rural areas. SIRD has manufactured 2000 and three-layer cotton mask (from Khadi cloth) and 2000 standard gloves as per WHO guideline through its trained women beneficiaries.

Society for Technology & Development (STD), Mandi, HP is mobilizing/helping the women SHGs, Kisan clubs & local voluntary organizations in making of reusable 3 layer cotton masks through videos as per guidelines. Initially 2000 masks have been produced by 7 SHGs from Nagwain, Panchayat, Sadar Block, Mandi HP. STD is also in process to conduct training/production on preparation of liquid hand wash from local materials having anti-microbial properties; such as Soap nut extract and Aloe vera in consultation with NBRI, Luck now/IHBT, Palampur.

Himalayan Research Group (HRG), Shimla is preparing 5000 face masks by the local women groups for distribution to selected Panchayats namely *Kamrunag, Kandhi and Jahal of Gohar* Block in District Mandi H.P. through active involvement of Panchayat Raj Institutions (PRIs) & distributing 1000 sanitizer bottles (100ml) as well. Promotion of local traditional crops like buckwheat, amaranth, red rice, barley, kidney beans, apricot and herbs like Chirayita (*Swertia cordata*) in mountains will not only ensure food nutrition and health but will also help in many therapeutic as well as livelihood needs of the community.

Vivekananda Institute of Biotechnology (VIB), Nimpith is serving people in ecologically fragile and climatically vulnerable area of *Sunderban*. College students are also being involved in health care measures such as spreading awareness at local level through print media, demonstrating the use Arogya Setu App.

During the health emergency declared due to COVID-19 by Kerala Government, Community Agro-Biodiversity Centre (CAbC), M.S. Swaminathan Research Foundation (MSSRF) Wayanad, Kerala demonstrated preparation of hand sanitizer (as per the WHO guidelines) to various departments viz., District Administration (District Collectorate), Excise Department and District Medical Authority (DMO) for its bulk production. In addition, MSSRF also supplied ready to use hand sanitizer (20L) prepared in the laboratory by using the available Isopropyl Alcohol to the District Administration and the Assistant District Magistrate (ADM) upon their request. Sanitizer was also supplied to the local Youth Clubs and Grocery shops and the public (15L). MSSRF has also joined hands with the State level campaigns for spreading awareness on the importance of personal hygiene and social distancing to combat COVID-19 infection via social media.

These organizations stood out because of their commitment towards community and served 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. Sardar Patel Renewable Energy Research Institute (SPRERI), Anand, Gujarat though constrained due to license related issues but has plans to produce hand sanitizer around 3500 bottles of 100 ml capacity for rural healthcare centres and Asha workers in rural and tribal areas of Anand & ChotaUdepur District, Gujarat.

(https://www.who.int/gpsc/5may/Guide_to_Local_Production.pdf).

(<http://164.100.117.97/WriteReadData/userfiles/FINAL%20MASK%20MANUAL.pdf>).

Creating Awareness and Capacity Building for Social Protection

Government of India is taking all necessary steps to ensure that community is prepared well to face the challenges and threat posed by the growing pandemic of COVID-19. Field

agencies and volunteers are supporting government actively towards containment of this disease in our country. The most important factor in preventing the spread of the virus locally is to empower the citizens with reliable trustworthy information and taking precautions as per the advisories issued by Ministry of Health & Family Welfare time to time. S&T led Voluntary Organizations played their role efficiently towards this goal using conventional and innovative methods of awareness creation using various platforms such WhatsApp, emails and Community Radio. Some noteworthy activities of these Groups in last 15 days in this direction are as follows:

Gorakhpur Environmental Action Group (GEAG), Gorakhpur, UP started working immediately before the lockdown, when news of COVID-19 started pouring in with a specific strategy to tackle the COVID-19 in rural areas at the community level in *Gorakhpur, Mahoba, Bhadohi* districts in Uttar Pradesh and *Supaul and West Champaran* in Bihar. The organization responded with three level strategy.

a. Awareness Generation at Community level: In regular project meetings and activities, community members were briefed on preventive measures about COVID-19 as per the prescribed guidelines of Central and UP Governments.

b. SMS-based Advisories: GEAG works with large network of small & marginal farmers linked with GEAG's weather-agro advisories, received on their mobile phones. GEAG made opportunistic use of this facility, and developed a SMS-based advisory on preventive measures for current harvesting season keeping in mind the COVID-19 outbreak. The advisory included the information related to personal hygiene, handwashing, use of masks and social distancing norms to be followed during harvesting of crops. The advisory is being sent regularly at an interval of 5 days to about 1887 farmers.

c. Community Volunteers as 'Corona Warriors' Frontline workers such as ASHA, Anganwadi Workers, Village Pradhan, Teachers and Volunteers have an important role to play in sensitizing the communities and guiding them. These frontline workers were sensitized about the severity of COVID-19 pandemic and they were encouraged to disseminate the necessary information to the communities to protect against the spread of Coronavirus.

d. Helping underprivileged farmers and families : GEAG also supported needy and poor farmers through Self Help Groups (SHGs) and Krishi Seva Kendra at the village level. Following support is being provided to the farmers and vulnerable groups:

- Technical support to the farmers on phone regarding cultivating vegetables with appropriate precautionary measures.

कोरोना से बचाव के लिए पोस्टर के माध्यम से किया जागरूक



साथ के लोगों के सम्पर्क में रह करोंना विरुद्ध जागरूक करने का प्रयास

खबरदार	सारी तकिया	दिल्ली के लोगों के सम्पर्क में रह करोंना विरुद्ध जागरूक करने का प्रयास
कोरोना वायरस एक अत्यंत घातक बीमारी है। यह श्वसन तंत्र के माध्यम से फैलता है। इसके लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं। यह बीमारी के लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं। यह बीमारी के लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं।	कोरोना वायरस एक अत्यंत घातक बीमारी है। यह श्वसन तंत्र के माध्यम से फैलता है। इसके लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं। यह बीमारी के लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं।	दिल्ली के लोगों के सम्पर्क में रह करोंना विरुद्ध जागरूक करने का प्रयास। यह बीमारी के लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं। यह बीमारी के लक्षणों में बुखार, सعال, श्वसन तंत्र की तकिया, थकान, कमजोरी और श्वसन तंत्र की तकिया शामिल हैं।

News Coverage: Jansandesh Times, Badhoi edition, dated 10.04.2020



- ii. Information related to availability of small equipment and organic inputs like neem cake, bone meal, Trichoderma etc. and vegetable seeds at Agro Service Centers free of cost to the needy farmers.
- iii. Community level Grain Banks were used to provide wheat and rice to agriculture laborer families stranded due to lockdown.
- iv. Cooked food was provided to some poor families in the villages
- v. The 3 SHG group of Gorakhpur and members of Village Disaster Management Committee of Laxmipur Rampurwa, of Bagha block West Champaran constituted under the project (Supported by Lutheran World Relief) have come forward to support their fellow community members and frontline workers by developing clean cloth masks and distributing them in the village. **GEAG distributed 220 masks in Gorakhpur and West Champaran districts to the vulnerable house holds especially in HarijanTola.**



In Central India, Madhya Pradesh reported third highest cases of COVID-19 with Indore district emerged as the hotspot. Daily earner groups like hawkers, laborers, rag pickers, vegetable sellers, beggars, workers working in unorganized sectors etc are highly vulnerable groups facing severe challenges such as lack of food, medicines, medical facility (inaccessible due to lockdown). DST supported group Madhya Pradesh Vigyan Sabha (MPVS), ensured the availability of foods/Ration kit, medicines, and medical facility and also created awareness among such highly vulnerable group, It reached out to network partners like Bharat Gyan Vigyan Samiti (BGVS), Peoples Science Movement (PSM), Democratic Women Organisation (JMS) and Jan Swasthya Abhiyan (JSA) MP Chapter in 11 Districts of MP (Bhopal, Indore, Chhindwada, Hoshangabad, Katni, Sheopur, Morena, Sehore, Bhind, Jhabua and Badwani) and created a group of 60 volunteers. These volunteers are working on awareness generation activities related to COVID-19 to communities through WhatsApp, emails and addressed challenges pertaining to wellbeing of elderly through psychological counseling, lack of food and medicines, rescue of migrant people in 25 districts of Madhya Pradesh and intensively in Bhopal. MPVS is working towards the nutritional food requirement of distressed people through 11 Community Kitchens.

Table: Activities by MPVS, Bhopal : Response to COVID-19

SN	Activities	No
1.	Cooked food packet supply through 4 Community Kitchens in Bhopal	7500
2.	Dry food packets Distributed	3000
3.	No of persons rescued	150
4.	Masks distributed in Tamia, Katni, Sheopur and Bhopal	2000
5.	Medical facility provided through our Doctor's Group	185
6.	Counseling done through our Counselor's Group	115

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE AND SOCIETY

DEPARTMENT OF BIOTECHNOLOGY (DBT)

Efforts for COVID19 Diagnostics Services

To scale-up testing of COVID-19 samples in government institutions across the country, DBT has established 21 City/Regional clusters in a Hub-and-Spoke Model. Institutes and Laboratories which have the capacity and expertise for both sample collection, handling/processing (BSL-2 facility) and testing (RT-PCR) serve as the hubs and they involve a number of laboratories which have RT PCR machines and the requisite manpower as their extended testing facilities. In accordance with the advisory issued by ICMR for COVID-19 testing by laboratories operational under DBT, nine Autonomous Institutes (AIs) of DBT have been approved as testing centres for COVID-19 diagnosis. Also these AIs have been identified as hubs for the 21 City/Regional clusters that have been established as part of the hub-and-spoke model to scale up testing. Since 15th April, 2020 more than 7.22 lakhs samples have been tested by these clusters.

Andhra Pradesh Med Tech Zone (AMTZ) is a common shared facility to manufacture diagnostic kits and ventilators. AMTZ is operationalizing indigenous manufacturing of kits and reagents for testing. At present, it has developed manufacturing capacity of 3 lakh RT-PCR kits/month, 1 lakh RNA extraction kits/month, and 1 lakh VTM/month.

Hon'ble Minister of H&FW, S&T and ES, Dr Harsh Vardhan, in the presence of Secretary, DBT, launched India's first I-lab (infectious disease diagnostic lab) to ramp up the COVID-19 testing in rural and inaccessible areas; DBT has supported AMTZ through the COVID-Command strategy of the National Biopharma Mission for building these mobile testing labs.





The first I-Lab is operational and is attached to the THSTI, Faridabad hub. It visited in and around villages and colonies of Faridabad, Ballabgarh, and Palwal and has tested 2746 samples in total. One of the DBT's Biodesign Centre, Healthcare Technology Innovation Centre (HTIC) at IIT Madras and Helyxon, a healthcare start-up in IIT Madras Research Park have successfully deployed a jointly developed remote patient monitoring solutions for COVID-19. The device is a first-of-its-kind in the market that does clinically accurate continuous monitoring of four critical parameters – Temperature, Oxygen Saturation, Respiratory Rate, and Heart Rate. The device is completely self-contained, portable, wireless, and can be clipped on to the patient's finger and the data is streamed to a mobile phone or central monitoring system.

COVID19 diagnostics and testing: Enabling indigenous manufacturing of diagnostic kits and allied reagents

In keeping with the Hon'ble Prime Minister's vision of marching towards 'Atmanirbhar Bharat', DBT is supporting mobilization of indigenous resources and manufacturing as evidenced in the next section.

DBT-AMTZ CoMMAND (COVIDMedTech Manufacturing & Development Strategy) Consortium, supported under National Biopharma Mission (NBM), enabled rapid scale-up of manufacturing of COVID-19 diagnostic kits effectively lowering import dependency. Nearly 5 lakh diagnostic testing kits per day (inclusive of RT-PCR tests, antibody tests, and ELISA kits) are being manufactured. In a short span of two months, 100% indigenization has been achieved with respect to production of COVID-19 diagnostic kits. Also, DBT extended support, through NBM, to Mylab Discovery Solutions, Pune, for scaling up production of fully indigenous COVID-19 Pathodetect testing kit. Currently, Mylab has a manufacturing capacity of 2,00,000 RT-PCR tests and 50,000 RNA tests.

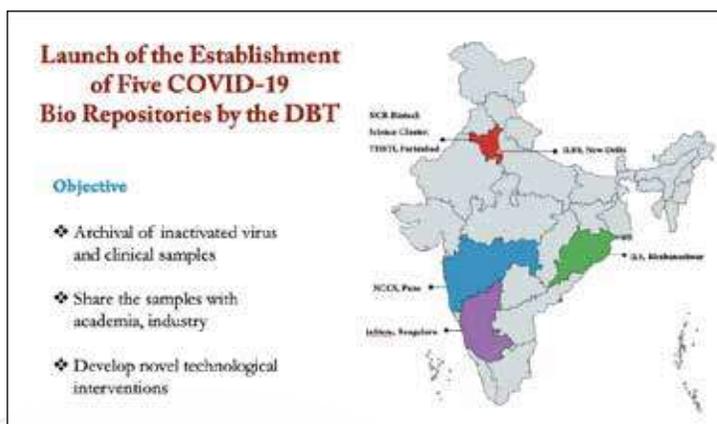
National Biomedical Resource Indigenization Consortium (NBRIC), a PPP (Public Private Partnership) initiative of DBT in partnership with ABLE (Association of Biotechnology Led Enterprises) and CII (Confederation of Indian Industry), to foster indigenous innovation and biomanufacturing, became operational since May 1, 2020. It has a focus on developing reagents, diagnostics, and therapeutics for COVID-19. Nearly 40 manufacturers of RT-PCR and Serology kits are part of the Consortium, which is growing by the day.

Services and facilities offered by DBT Autonomous Institutes

i) Biorepositories

DBT's Autonomous Institutions THSTI, ILS, RCB, and inStem have been chosen for establishment of biorepositories to enable equitable access to COVID-19 biospecimens and foster relevant research. The biorepository at THSTI holds around 4000 samples and has shared nearly

2500 samples till date. The biorepository at THSTI has also developed sample panels to aid diagnostics, including panels of sera for antibody testing, positive and negative controls for diagnostic assays, standardized panels of nasopharyngeal/oropharyngeal samples for testing of antibodies, viral strains, and inactivated viruses.



ii. Antiviral testing

Six DBT AIs, viz., THSTI, RGCB, ILS, RCB, IBSD, and ICGEB have been identified for testing of investigational new products. Nearly 20 requests have been addressed by RCB so far.

iii. Validation of diagnostic kits

Five AIs of DBT, RGCB, ILS, THSTI, inStem, and ICGEB have been recognized for validation. Validation of nearly 10 serology and RT PCR diagnostic kits has been completed by THSTI and RGCB.

Other Interventions

DBT-inStem is developing masks and surgical gowns coated with a disinfective chemical that can kill the virus on contact. DBT-inStem has designed COVIDGyan website along with other institutions to disseminate verified information and knowledge and create awareness about the disease and approaches for understanding and management.

DBT-IBSD is finalizing the draft of the monographs of NER medicinal plants with anti-viral properties of NER. Efforts are on to complete this compendium within this month end.

Development of point-of-care screening and patient monitoring devices, PPEs, low-cost mechanical ventilators/respirators, hand sanitizers and disinfectant platforms, biodegradable antiviral masks, high oxygen flow devices, and ventilation systems are some of the preventive solutions being supported. BIBCOLD, a PSU of DBT, has developed a hand sanitizer. A contribution of Rupee One will go to PM Cares Fund from each single bottle of the sanitizer sold commercially.

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE AND SOCIETY

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

Promoting Rural Entrepreneurship & Employment

Given the prevailing scenario and large movement of migrant labour to rural and semi-rural areas, CSIR is taking steps to enhance their livelihood. It is planning to support the creation of Rural/Social Enterprises through rural entrepreneurship with support from industry. Training on Disinfectants, Sanitizers, Soaps, Masks, Gloves, Food Products, Water Purification kits, etc. will be provided through social and voluntary organizations. CSIR is in discussion with two such organizations in Madhya Pradesh and Uttarakhand, respectively. Other initiatives include:

- CSIR-NEIST has been training people in the North East for facemask making and other activities.
- CSIR-NIIST transferred technology for making Trikatu syrup to Trivandrum-district Palm Products Development Cooperative Federation Ltd., Parassala, Trivandrum.
- Breeding, agrotech and germplasm-related research activities of Medicinal and Aromatic Plants being undertaken by skeletal farm staff of CSIR-CIMAP during COVID-19. These high-value crops will help in enhancing farmer's income in rural areas.

For more information:

<https://covid19csir.urdip.res.in/societal1.jsp>

Facemasks

- CSIR-CMERI taken initiative for conducting outreach programme to empower rural women and trained them for making facemasks and earn their livelihood during lockdown period. It also provided more than 68000 masks for the earning of women entrepreneurs and to support those who could not afford the meagre amount.
- CSIR-CECRI has transferred technology of making reusable facemasks and in the first phase 5000 reusable cotton cloth facemasks were distributed by the Karur District Collector at the Textile city of Karur. It also handed over PPE materials to ASP, Devakottai GH, and Kalayarkoil Superintendent of Post office.
- CSIR-CSMCRI has provided 500 masks to the Gujarat Police, and 500 membrane-based facemasks made by the organisation were given for user trial and feedback to Indian Red Cross Society, Bhavnagar Branch

For more information:

<https://covid19csir.urdip.res.in/societal2.jsp>

Hand Sanitizers

CSIR delivered immediate relief by providing hand sanitizers, soaps and disinfectants to mitigate COVID-19.

- So far, more than 50,000 l of hand sanitizers and disinfectants have been produced within the laboratories of the CSIR and distributed among more than 100,000 people belonging to various sections of the society.
- Besides, the laboratories also networked with local administration to distribute sanitizers and disinfectants among personnel belonging to the police force, municipal corporations, electricity supply undertakings, medical colleges, hospitals, panchayats, and banks and several others.
- CSIR-IIIM distributed hand sanitizer to DGP office of J & K and 15 JAT Regiment of Indian Army.
- CSIR-IITR provided 200 l of WHO-formulated Hand-rub sanitizer for frontline health workers including Doctors of King George's Medical University (KGMU).
- CSIR-CIMAP handed over 500 bottles of herbal sanitizers to be distributed among police personnel.
- CSIR-CLRI handed over of the 4th batch of Hand Sanitizers, 130 l to City Medical Officer, Greater Chennai Corporation, Tamil Nadu to support the Chennai Corporation Employees and Hospital workers to protect them from COVID-19.
- Masks and soaps/sanitizer were distributed by CSIR-AMPRI, Bhopal in Panchsheel Nagar, Rahul Nagar, 12 No. Slum area, Pumpapur, etc. areas/village of Bhopal district.
- CSIR-IMMT has installed Hands-free Hand Wash and Sanitization system at Police Seva Bhavan and the office of DCP-Bhubaneswar.

For more information:

<https://covid19csir.urdip.res.in/societal3.jsp>



CSIR-IITR handed over Hand Sanitizer to Hon'ble CM of UP



CSIR-NEIST handed over Hand Sanitizer & Disinfectant at Air Force Station, Jorhat



Ready-to-eat protein and micronutrient-rich food being given to migrants in Bengaluru and patients at AIIMS, New Delhi by CSIR-CFTRI

Food Distribution

- Several RTE products have been developed by CSIR-IHBT and CSIR-CFTRI which are available through licensee/s for scale-up and distribution to the COVID-19-affected persons. These products include: Herbal Khichdi (packed in tin cans or pouches) and 'Dal Chawal Aloo Mix' (425 gm packed in tin cans) developed by CSIR-IHBT and High protein biscuits; high protein rusks fortified mango bar; Nutra chikki with added Spirulina and cardamom flavored water developed by CSIR-CFTRI are the key RTE products available for scale-up.
- CSIR-CFTRI has distributed 7 tonnes of high protein biscuits, 1 tonne of spirulina chikki, 10 tonnes of flavoured water, and 5 tonnes of fruit bars reaching 31,278 migrant labourers in Bangalore/Delhi, hospital patients, doctors and police departments in two metropolis. The food was manufactured by CSIR-CFTRI licensees as per the Institute's specifications and the supply chain logistics were provided by NGOs and other philanthropic groups.
- CSIR-CIMFR staff posted at coal and mining sites are also contributing and serving needy people in different parts of the country.

For more information:

<https://covid19csir.urdip.res.in/societal4.jsp>



SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE AND SOCIETY

INDIAN COUNCIL FOR MEDICAL RESEARCH (ICMR)

Advisories on the use of Hydroxychloroquine (HCQ) as prophylaxis for SARS CoV2 infection

ICMR has released revised versions of advisories on the use of Hydroxychloroquine as prophylaxis for SARS-CoV-2 infection. The Joint Monitoring Group under the Chairmanship of DGHS and representatives from AIIMS, ICMR, NCDC, NDMA, WHO, and experts drawn from Central Government hospitals reviewed the prophylactic use of HCQ in the context of expanding it to healthcare and other frontline workers deployed in non-COVID and COVID areas, respectively. This advisory supersedes the earlier related advisory dated 23rd March 2020. It has been reiterated in the advisory that the intake of HCQ should not instil a sense of false security.



Website Link:

<https://www.mohfw.gov.in/pdf/AdvisoryontheuseofHydroxychloroquinasprophylaxisforSARSCoV2infection.pdf>

Guidance for appropriate recording of COVID-19-related deaths in India

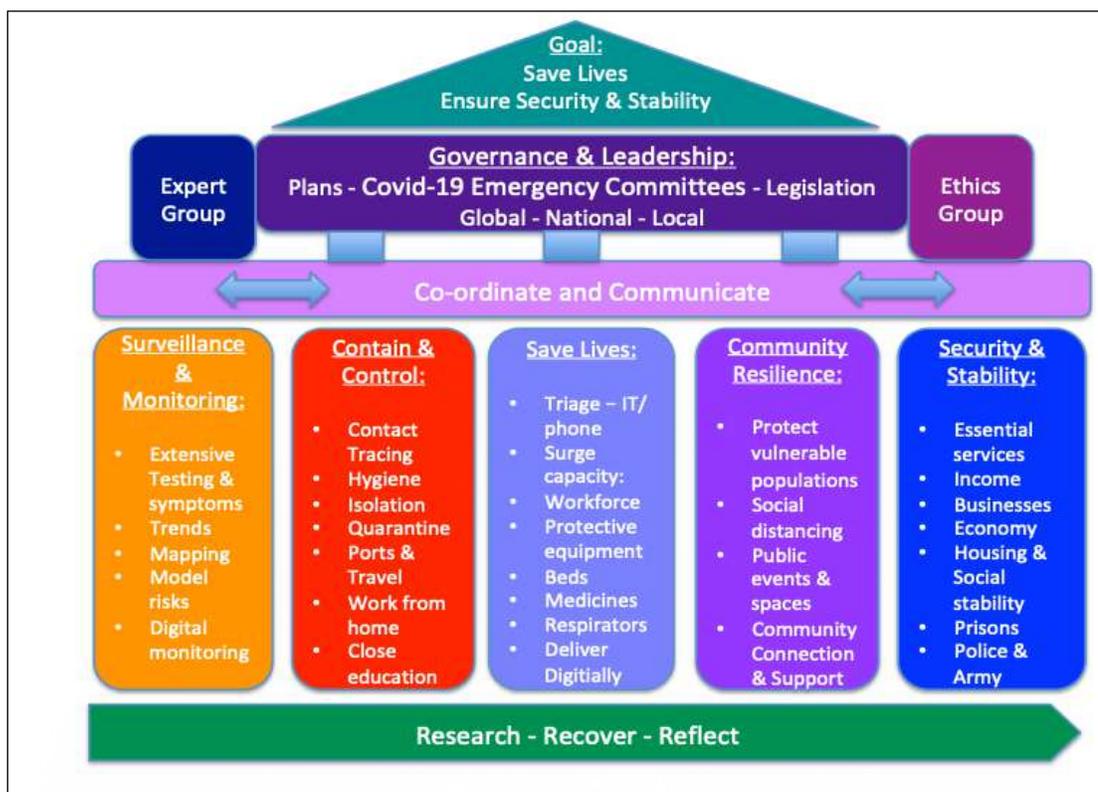
ICMR has released guidelines for appropriate recording of COVID-19-associated deaths. The cause of death (COD) is defined as “all those diseases, morbid conditions or abnormalities, injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries.” The guideline entails the detailed description of how to record COVID-19-related deaths.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/Guidance_appropriate_recording_of_related_deaths_India.pdf

National guidelines for ethics committees reviewing biomedical & health research during COVID19 pandemic

ICMR has released National Guidelines for Ethics Committees Constituted for Reviewing Biomedical and Health Research during COVID-19 Pandemic. The instructions are developed by its bioethics unit NCDIR, Bengaluru, under the guidance of COVID-19 National Ethics



Committees (CoNEC). The document highlights the critical and facilitatory role that the ethics committees need to play in supporting the ethical conduct of research in India.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/EC_Guidance_COVID19_06052020.pdf

Guidelines for liver transplantation amid COVID-19 infection

ICMR has issued the guidelines to address the issues specific for liver transplantation considering the impacts of the outbreak of COVID-19 Pandemic. These guidelines have been prepared by Liver Transplant Society of India (LTSI). The guidelines include various aspects of COVID-19 diagnostics during, pre, and post liver transplant.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/Guidelines_for_Liver_Transplantation_and_COVID_13042020.pdf

Guidance for Management of Pregnant Women in COVID-19 Pandemic

ICMR has issued the guidelines on management of pregnant women in COVID-19 pandemic in which it provides different recommendation for pregnant women during COVID-19. These recommendations are adapted based on guidelines from international agencies like CDC, ACOG, RCOG, FOGSI, and Lancet publications. However, they are simplified and made user friendly for Indian context. This guidance is prepared considering resources in our government health settings.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/Guidance_for_Management_of_Pregnant_Women_in_COVID19_Pandemic_12042020.pdf

India COVID-19 Clinical Research Collaborative Network

The National Task Force has recommended establishing the “India COVID-19 Clinical Research Collaborative Network” to be coordinated by the ICMR. The goal of this network is to enhance the clinical understanding of COVID-19 in the country so as to develop specific clinical management protocols and further R&D for therapeutics. For this purpose, a central database of clinical and laboratory parameters of hospitalized COVID-19 cases are being created. All hospitals currently managing COVID-19 patients are invited to become partners in the network.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/COVID_Clinical_Network_ICMR_06042020.pdf

MoHFW Guidelines on Dead Body Management

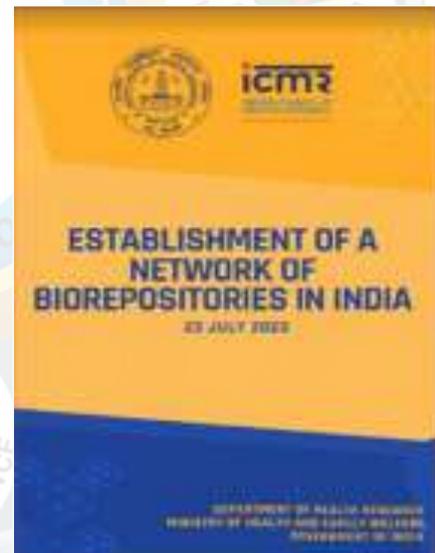
Ministry of Health and Family Welfare (MoHFW) releases guidelines on dead body management of COVID-19 patients. This guideline is based on the current epidemiological knowledge about the COVID-19. India is currently having travel-related cases and few cases of local transmission. At this stage, all suspect/confirmed cases will be isolated in a healthcare facility. Hence, the document is limited in scope to hospital deaths.

Website Link:

https://www.mohfw.gov.in/pdf/1584423700568_COVID19GuidelinesonDeadbodymanagement.pdf

Guidelines for operational mechanisms for establishing COVID-19 Biorepositories

In the backdrop of the COVID-19 pandemic, while it is of paramount importance to provide early diagnosis and treatment to all infected individuals, it is also critical to promote research and development for larger public health benefit. For development and validation of new diagnostics, therapeutics, or vaccines, access to different kinds of clinical samples from infected patients is an essential requirement. NITI Aayog has recently issued guidelines for sharing of biospecimens and data for research related to COVID-19. This document, released by ICMR on 23rd July 2020, in tandem, lays down the brief processes and operational mechanisms for establishing COVID-19 biorepositories in the country. Currently, there is no structured mechanism for collecting and storing these valuable clinical samples. In view of this, it is important to create designated biorepositories for collecting, storing, and maintaining clinical samples (Oropharyngeal/Nasopharyngeal swabs, Bronchoalveolar lavage, Sputum, Blood, Urine and Stool) of COVID-19 patients. Such samples will be used to develop validated diagnostics, therapeutics, vaccines, etc. Additionally, the samples will be a valuable resource for research & development-related activities to understand the early predictors of disease severity, immunopathogenesis of the disease, etc.



Website Link:

<https://www.icmr.gov.in/cbiorn.html>

Additional strategies for COVID-19 diagnostic testing

Since 'test, track and treat' is the only way to prevent spread of infection and saving lives, it is imperative that testing should be made widely available to all symptomatic individuals in every part of the country and contact tracing mechanisms for containment of infection are further strengthened. On 23rd June 2020, ICMR released advisories, in addition to earlier ones, for all concerned public and private authorities and institutions to take required steps to scale-up testing for COVID-19 by deploying combination of various tests as advised in the advisory.

Website Link:

https://www.icmr.gov.in/pdf/covid/strategy/New_additional_Advisory_23062020_3.pdf

List of IgG ELISA/CLIA kits for COVID-19 validated by ICMR identified validation centre

Sero surveys help to understand the proportion of population exposed to infection including asymptomatic individuals. Depending on the level of sero prevalence of infection, matching public health interventions can be implemented for prevention and control of the disease.

The Survey is conducted in high-risk or vulnerable populations (healthcare workers, frontline workers, immune compromised individuals, individuals in containment zones, etc.) to know who has been infected in the past and has now recovered.

List of IgG ELISA/CLIA kits for COVID-19 are

1. ZydusCadila Healthcare Ltd., Ahmedabad (Gujarat), India: COVID KavachIgG ELISA;
2. Euroimmun US Inc., USA: Euroimmun Anti-SARS-COV-2 IgG ELISA;
3. Calbiotech Inc., USA: Erbalisa COVID-19 IgG ELISA;
4. YHLO iFlash, China: SARS-CoV-2 IgG CLIA;
5. Karwa Enterprises Pvt. Ltd, Delhi, India: KAVACH Karwa SARS-CoV-2 IgG ELISA; and
6. Voxtur Bio Ltd., (Mumbai), India: VOXEL Anti-SARS-COV-2 IgG Antibody detection kit COVID KAVACH.

ICMR has transferred COVID KavachIgG ELISA technology to below mentioned pharma companies:

ZydusCadila Healthcare Ltd; Meril Diagnostics Pvt. Ltd; Voxtur Bio Ltd.; Trivitron Healthcare Pvt. Ltd; J. Mitra & Co. Pvt Ltd; Karwa Enterprises Pvt Ltd; and Avecon Healthcare Pvt Ltd.

Website link:

https://www.icmr.gov.in/pdf/covid/kits/ELISA_CLIA_Kits_List_07082020.pdf

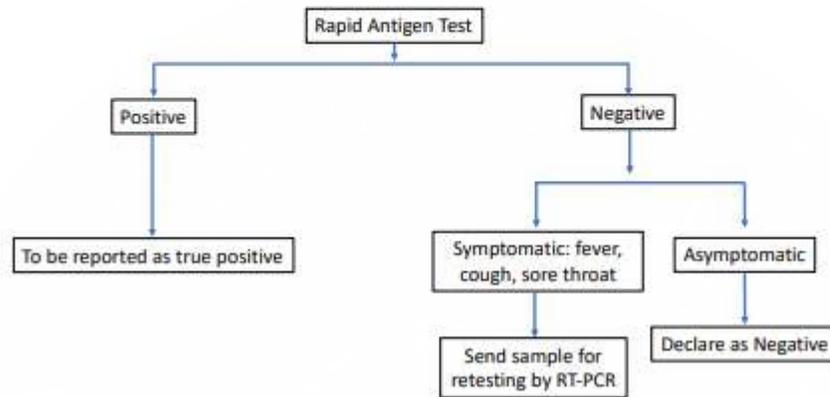
Advisory on District wise login credentials for rapid antigen testing for COVID-19

ICMR has invited researchers/entrepreneurs to come up with such testing kits, which are accurate and useful. Efforts are being made to validate such kits and make multiple options available for use. With the use of antigen tests, more and more tests are being carried out. It is absolutely necessary that all such testing data is uploaded on the ICMR database and all positive cases are brought to the attention of district/municipal authorities for isolation/quarantine/treatment, as the case may be. It is expected that to provide safe healthcare services, all Government hospitals/labs as well as all private NABH/NABL hospitals/labs may initiate antigen testing and also apply for obtaining login credentials for data entry into the ICMR portal.

ICMR has been receiving multiple requests from various public sector units, small private/ government facilities, temples, etc. for initiating this testing.

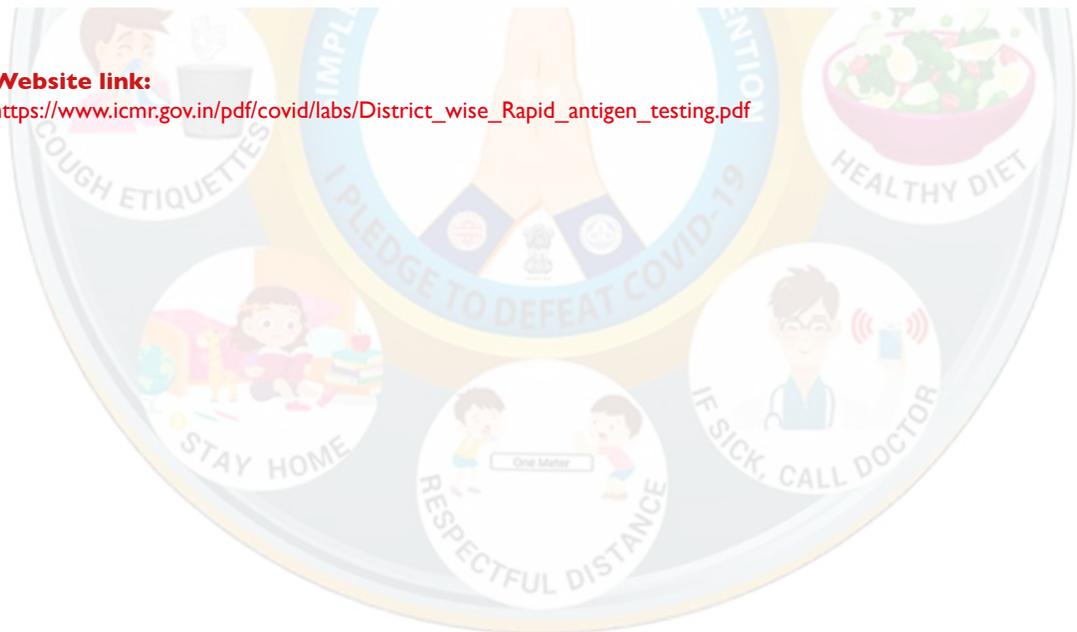
In a further effort to facilitate and further liberalize testing, ICMR has generated five common login credentials for each district of your State/ UT, which may be shared with all Government and private facilities selected for antigen testing. A nodal person from the respective State/ UT can also be nominated, who could contact the ICMR team for obtaining login credentials.

Algorithm for COVID-19 testing using rapid antigen point-of-care test



Website link:

https://www.icmr.gov.in/pdf/covid/labs/District_wise_Rapid_antigen_testing.pdf



SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE AND SOCIETY

DEFENCE RESEARCH & DEVELOPMENT ORGANISATIONS (DRDO)

DRDO has been tracking the alarming spread of COVID-19, since the world media started reporting its devastating impact in China's Wuhan Province. DRDO has been on alert since the detection of the 1st case of COVID-19 in India, reported on 30th January 2020. DRDO Laboratories working under life sciences cluster and many other labs with the possibility of producing spin-off technologies geared to support national mission to combat COVID-19.

By first week of March 2020 the number of affected people in India had crossed 30. DRDO then took a decision to accelerate and enhance products and countermeasures to combat the spread of COVID-19 in India. Efforts were focused on creating required solutions without losing time, within the given constraints and available resources.

As a result of this approach, DRDO made ready many technologies and products which could be utilized for combating COVID-19. DRDO worked with industry for volume production of some of the products which are applicable for containment of COVID-19. Information was freely provided about the products developed for combating COVID-19 and innovative interventions for specific applications.

DRDO has also undertaken a number of support activities to assist Corona Warriors and has used its technology to develop equipment to fight against Corona Pandemic in the country. A category-wise summary on societal contributions made by DRDO as on date is listed below:-

Sanitization Products		
S.No.	Product	Quantities Distributed
1	3-ply, N95 and N99* masks	412850
	*Production capacity of N99 ramped up to 2 Lakh Masks per week Total order of 22 Lakhs N99 Masks is placed by HLL on DRDO developed industry for DRDO designs out of which a total of 8,32,300 Masks of DRDO N99 mask are supplied to HLL	
2	Hand Sanitizers	905494Units
3	Personnel Sanitization Systems	09
4	Area Sanitization Systems	16
5	Vehicle Sanitization System	12
6	Automatic Mist Based Hand Sanitizer Dispensing Unit	193Units
7	Multi-purpose Access Tool	1500
8	Touch Sanitizer Pen	620

PPE Products

S.No.	Product	Remark
1	Face Protection Shield	About 35,100 distributed
2	Aerosol Protection Enclosure	About 60 distributed
3	PPE Coverall Suit	24618 Distributed

About 75000-80000 DRDO designed PPE's are being produced daily

About 35 Lakh Units of PPE Coverall suits of DRDO designs have been ordered to the industries by M/s HLL

COVID-19 Sample Testing Products/ Facilities

S.No.	Activity/ Facility	Numbers
1	Covid-19 Samples Tests	20886 Tests
2	Evaluation of PPE Suits samples	2921
3	Filtration efficiency test for Mask/Fabric	930
4	Covid Sample Collection Kiosk (by two laboratories)	03 Kiosks
5	Virology Research and Diagnostics Laboratories	02 Labs
6	Body Temperature Probe (Contact and No-contact Type)	10 Numbers Distributed
7	SardarVallabhBhaiCovid Hospital	Hospital

Other Technology Spin off Products by DRDO

S.No.	Product	Status
1	Ventilators	About 1000 Delivered This month. Delivery continues through the coming months
2	Medical Aids	DEVEN & SOAR
3	Medical Oxygen Plant & Cylinders	Order Placed by AAI on Trident for 3 Systems
4	Multi-patient Ventilators Kit	Prototype under testing
5	Software Products for Quarantine Tracking, Video conferencing and COVID-19 Infections Prediction	About seven separate modules developed
6	Packed Food, Juices etc.	> 1.5 Ton Distributed
7	Daily Food Distribution by Various Labs to Poor and Needy	>5 Tons Distributed
8	UV-Bath for Luggage at Kochi Airport	Fabricated, coordinated the deployment and given the UV lamps etc
9	Medical Use Robots	ToT Done
10	UV Disinfection Devices	10 Variants



In addition, DRDO labs have configured isolation shelters in various capacities. All labs have extended logistics support to local administration and state government authorities. Food packets have been distributed to the needy. Raw material/ products developed by DRDO have been distributed pan India with more than 20,000 Kms daily movement synergistically with other departments/ ministries.

The products of DRDO are being produced by about 100 primary industries in the country and numbers is increasing as efforts are being matured and products are qualifying tests by concerned hospitals and other users. The details of industry partners collaborations with respective laboratories is provided on DRDO website. <https://drdo.gov.in/>.

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE AND SOCIETY

MINISTRY OF AYUSH

Ministry of AYUSH released following guidelines to facilitate the research in various branches of alternative medicine for the usage of the scientific fraternity:

- Guidelines For Naturopathy Practitioners For COVID-19
- Guidelines For Siddha Practitioners For COVID-19
- Guidelines For Homoeopathic Practitioners For COVID-19
- Guidelines For Unani Practitioners For COVID-19
- Guidelines For Ayurveda Practitioners For COVID-19
- Guidelines For Yoga Practitioners For COVID-19
- Integrated AYUSH Guidelines for Public Health and Healthcare Practitioners for COVID-19

For more information, visit

<https://www.ayush.gov.in/>

Guidelines for AYUSH Clinical Studies related to COVID-19

The Ministry of AYUSH has constituted an Interdisciplinary AYUSH Research and Development Task Force for facilitating research on COVID-19.

The other short-term challenges include time available to design a study and lack of resources to conduct the study. Any research which is planned during such period should be based on thorough understanding of the disease and its importance as a public health challenge. The AYUSH Task Force has therefore recommended development of a guidance document for researchers that will discuss methodological components of a protocol for evaluating AYUSH interventions in COVID-19.

Website link:

<https://www.ayush.gov.in/docs/clinical-protocol-guideline.PDF>

Advisory for meeting the challenge arising out of spread of Novel Coronavirus in India

The holistic approach of AYUSH systems of medicine gives focus on prevention through lifestyle modification, dietary management, prophylactic interventions for improving the immunity, and simple remedies based on presentations of the symptoms.

The AYUSH approach to manage the outbreak broadly comprise of:

- Preventive and prophylactic;

- Symptom management of COVID-19 like illnesses; and
- Add on interventions to the conventional care.

Website link:

<https://www.ayush.gov.in/docs/125.pdf>

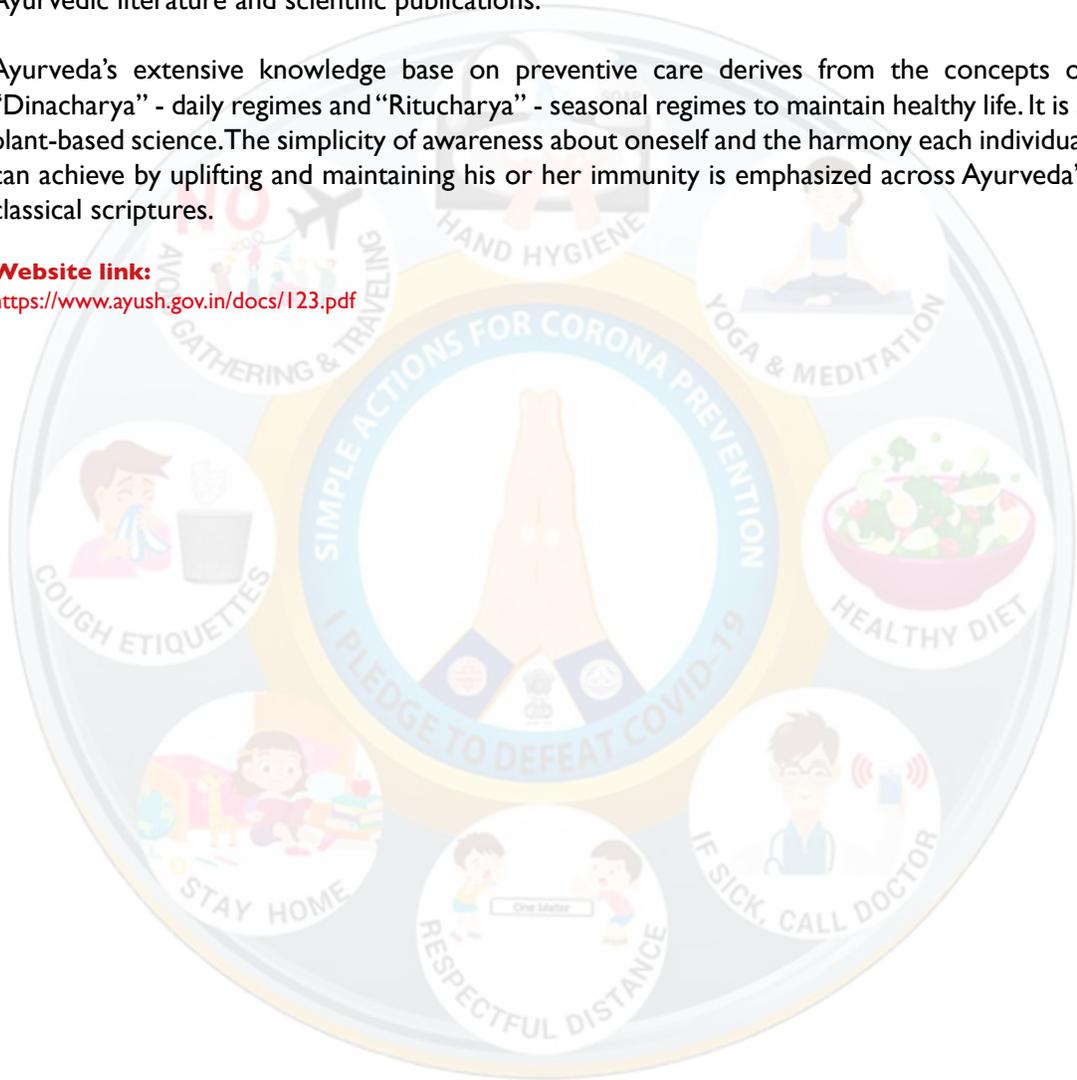
Ayurveda’s immunity boosting measures for self-care during COVID-19 crisis

Ministry of AYUSH recommended a series of self-care guidelines for preventive health measures and boosting immunity with special reference to respiratory health. These are supported by Ayurvedic literature and scientific publications.

Ayurveda’s extensive knowledge base on preventive care derives from the concepts of “Dinacharya” - daily regimes and “Ritucharya” - seasonal regimes to maintain healthy life. It is a plant-based science. The simplicity of awareness about oneself and the harmony each individual can achieve by uplifting and maintaining his or her immunity is emphasized across Ayurveda’s classical scriptures.

Website link:

<https://www.ayush.gov.in/docs/123.pdf>



SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE OUTREACH & POPULARISATION

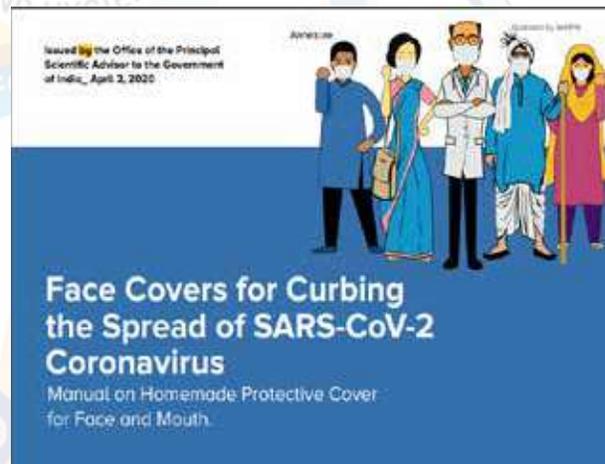
OFFICE OF THE PRINCIPAL SCIENTIFIC ADVISER (PSA)

Advisory on use of Homemade Protective Cover for Face & Mouth

The PSA's Office had issued the basic guidelines for the usage of homemade face cover for curbing the menace of novel coronavirus spread. To address the larger audience of general public, the advisory was found to be handy and significant in containing the transmission. Along with Hindi and English, this manual had been published in 16 various regional languages.

Website Link:

<http://psa.gov.in/information-related-covid-19/manual-homemade-protective-covers-face-mouth>

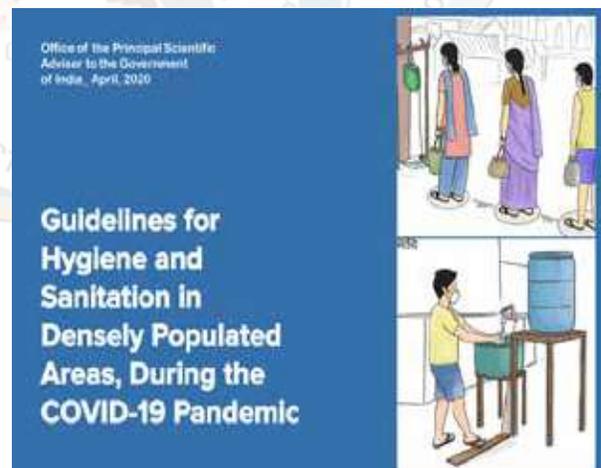


Guidelines for hygiene and sanitation in densely populated areas

In the initial days of COVID-19 pandemic outbreak in India, Office of the PSA had released guidelines for hygiene and sanitation in densely populated areas. The handbook provides an outline of guidelines which local bodies and communities can adopt easily to contain the transmission of the disease. Along with Hindi and English, the handbook had been published in Urdu and Marathi language.

Website Link:

<http://psa.gov.in/information-related-covid-19/guidelines-densely-populated-areas>



SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE OUTREACH & POPULARISATION

DEPARTMENT OF SCIENCE & TECHNOLOGY (DST)

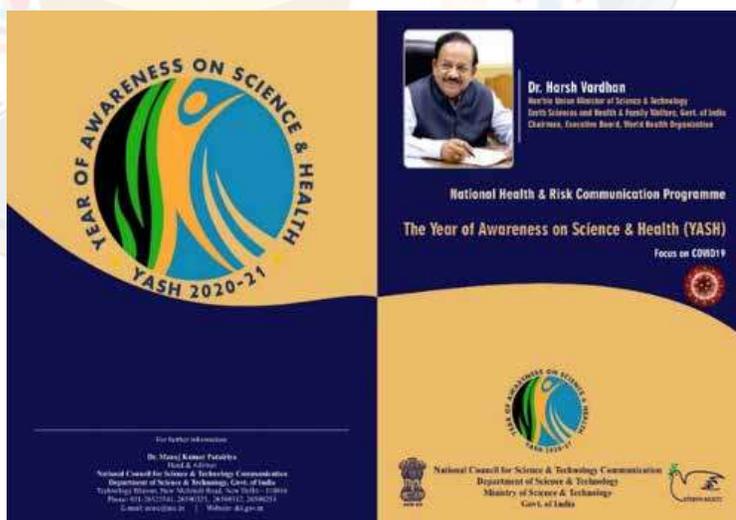
In the current scenario, where there is extreme amount of anxiety, depression and challenges vis-a-vis translation and usage of common minimum science and authentic information to communicate the risks and facilitate risk management, an immediate and effective science communication for promoting community level response was desired.

1. 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.
2. National Health and Risk Communication Programme ‘Year of Awareness on Science and Health (YASH)’ for COVID-19

National Council for Science & Technology Communication (NCSTC), DST launches a programme on health and risk communication “Year of Awareness on Science & Health (YASH)” with focus on COVID-19.

Special call for proposals has been announced for science, health and risk communication with focus on COVID-19 - building improved risk understanding, an analytical mind, and informed decision-making capacity among target groups including working with local sensitivities, belief systems, traditions, and indigenous knowledge; translation, target group-specific interpretations and usage of authentic scientific

and health information to communicate the risks and facilitate risk management; attitudinal changes about appreciating risks, associated challenges and solutions and assessment of public perceptions; improved ability to clarify mis-perceptions, mis-beliefs, mal-practices-



based authentic knowledge duly verified by scientific processes; trust in scientific competence of solutions and service providers and better working relations with community leaders, influencers including faith leaders, doctors, etc.; science literacy for risk reduction; development of science, health, and risk communication software in terms of publications, audio-visual, digital platforms, low-cost learning aids, folk performances, trained communicators, especially in regional languages; campaigns, hands-on science, demo/ exhibitions/fairs, mela, jatha, competitions, children centric outreach, etc.

For more information, visit:

<https://dst.gov.in/callforproposals/call-proposals-under-national-health-and-risk-communication-programme-year>

<https://dst.gov.in/sites/default/files/YASH%20Backgroundunder.pdf>

NCSTC brings out COVID Katha for sensitising common public towards COVID-19

The National Council for Science & Technology Communication (NCSTC), DST 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 has already been released. 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 COVID Katha: A Multimedia Guide for Mass Awareness, has said that the interpretation of science in common man's language is important for awareness among 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!

For more information, visit:

<https://dst.gov.in/ncstc-brings-out-popular-covid-katha-hindi>

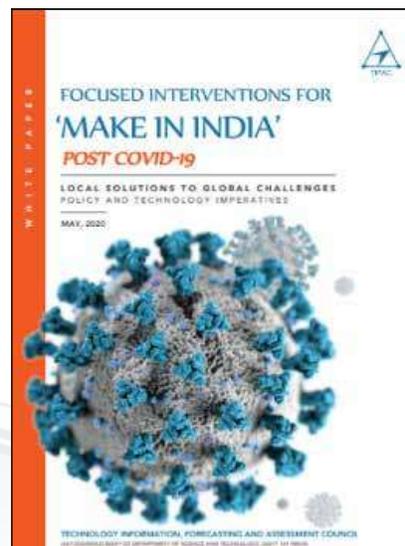
TIFAC releases White paper on 'Focused Interventions for 'Make in India': Post COVID-19'

Dr. Harsh Vardhan, Union Minister for Science & Technology, Health and Family Welfare and Earth Sciences today 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. Harsh Vardhan congratulated TIFAC “for bringing out this White Paper document at a right time when India is gearing up for boosting economy with a new Mantra “Local Solutions to Global Challenges - Policy and Technology Imperatives”. “The road to national economy recovery would traverse through measures like Policy support to unconventional strategies, leveraging into new international partnerships in important sectors of Agriculture, Electronics, Health, ICT and Manufacturing and providing new technology stimulus”, he added. Dr. Harsh Vardhan requested “our Industry friends, Research and Policy Bodies to refer this White Paper in designing the path for upliftment of economy.”

For more information, visit:

<https://dst.gov.in/dr-harsh-varadhan-releases-white-paper-focused-interventions-make-india-post-covid-19-tifac>



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 recently by Technology Information Forecasting and Assessment Council (TIFAC), an autonomous organization under the Department of Science & Technology, Government of India.



For more information, visit:

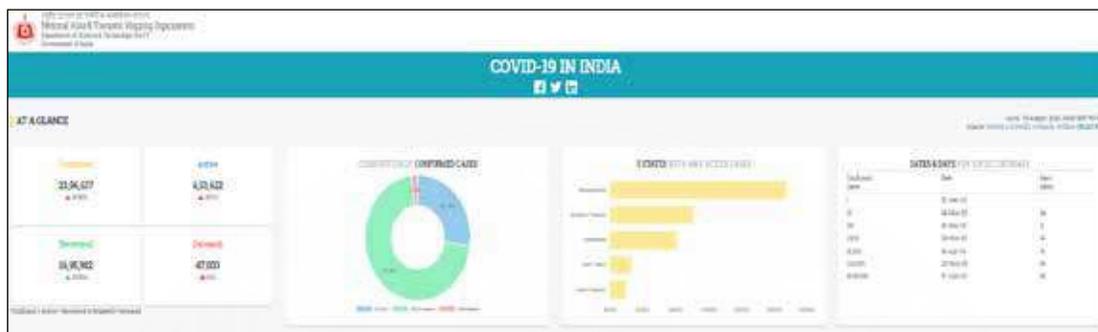
<https://dst.gov.in/tifac-releases-report-active-pharmaceutical-ingredients-status-issues-technology-readiness-and>

National Atlas & Thematic Mapping Organisation brings forth the COVID-19 dashboard to create awareness amongst general public

COVID-19 pandemic is a worldwide health disaster and a state of global emergency leading towards immense hardships throughout the world to fight against this deadly disease. Under such circumstances, spreading awareness among the citizen to overcome the anxious and worrisome panic, is solicited. Creation of visualisation of situation analysis through the dashboard is considered as one of the most popular approaches.

National Atlas & Thematic Mapping Organisation (NATMO) has taken an initiative to host the COVID19 dashboard, with the guidance from Geospatial Group, Department of Science & Technology, to create a single window platform to integrate all Government Department data including COVID19 combat initiatives. As part of the societal commitment, NATMO has

created the COVID19 DASHBOARD to provide up-to-date information on the COVID-19 Pandemic the nation is facing. The related information is covered under two headings, namely Dashboard and Information. The dashboard includes features related to the spread of COVID-19 pandemic based on the daily data updated and published by the Ministry of Health and Family Welfare. Information section contains the COVID-19 related information decentralised up to district level. Thematic layers such as COVID-19 health facilities, ICMR Test Labs and Blood Banks are available under this section.



For more information, visit:
<http://geoportal.natmo.gov.in/Covid19/>

Special issue of monthly e-Newsletter 'STRIDES' on COVID-19

STRIDES (Science Technology Research Innovations and Developments) - A Department of Science & Technology (DST) Communication e-newsletter has been developed to bring news on S&T Development from DST support and beyond. It brings together articles, news stories, features, blogs and event reports. The Newsletter gives snapshot of the science & technology in India with focus on the activities, achievements & events of DST and its Autonomous and attached Institutions. Through this effort, DST tried to bring to the table its efforts delegated towards research, technology and innovation that one would be interested to know and eventually update on the road to recovery and winning the combat.



For more information, visit:
<https://dst.gov.in/e-newsletter>

Book chapter on the structure of the coronavirus by RRI

The chapter includes general morphological features as well as ultrastructural 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. Theorists at 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.

India Science Channel

India Science is an Internet-based Over-The-Top (OTT) Science TV channel. It is an initiative of the Department of Science and Technology (DST), Government of India, implemented and managed by Vigyan Prasar (VP), an autonomous organisation of the Department of Science and Technology. 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 the 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, the 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 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. Weekly COVID-19 video bulletin: Produced in both Hindi and English language on weekly basis from 7 July 2020, COVID-19 bulletin apprises the audience about the latest development happening in S&T in India that are helping in managing and overcoming the challenges



thrown up by the pandemic. Vigyan Prasar produced daily COVID-19 Bulletin from 11th April to 06 July 2020. Thereafter, a weekly bulletin is being produced which provides the most important S&T updates for the country related to COVID-19 front.

2. COVID-19 Explained - Short films to explain important research finding related to COVID-19 in layman's lingo produced weekly basis. The subjects chosen for this short film caters to the curiosity of common man related to COVID-19.
3. Facebook live sessions on interviews of various stakeholders and media with DST Secretary.
4. Vigyan Prasar interviewed the following eminent personalities on the occasion of Independence day where they shared the work done by their respective departments against COVID-19 apart from other achievements and plans:
 - Prof. Ashutosh Sharma, Secretary, Department of Science and Technology, Government of India;
 - Dr. Madhavan Nair Rajeevan, Secretary, Ministry of Earth Sciences, Government of India;
 - Dr. G. Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, Defence Research and Development Organisation (DRDO), Government of India;
 - Dr. Shekhar C. Mande, Secretary, Department of Scientific and Industrial Research (DSIR) and Director-General, Council of Scientific and Industrial Research, Government of India;
 - Dr. Renu Swarup, Secretary, Department of Biotechnology, Government of India;
 - Shri Rameshwar Prasad Gupta, Secretary, Ministry of Environment, Forest and Climate Change, Government of India;
 - Dr. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education (DARE) & Director General, Indian Council of Agricultural Research (ICAR), Government of India; and
 - Prof. Randeep Guleria, Director, All India Institute of Medical Sciences, New Delhi.

For more information, visit <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. The ISTI web portal has been developed by VigyanPrasar, an autonomous organisation of the Department of Science and Technology (DST).

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.

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, around 1500 science stories on efforts and initiatives taken up to combat COVID-19 have been updated, along with tens of awareness material and enumerable infographics.

For more information, visit <http://indiainscienceandtechnology.gov.in/covid-19-the-pandemic>



E-Newsletter on COVID-19

For the benefit of its stakeholders and target audience, VigyanPrasar is bringing out a weekly e-Newsletter on the most relevant initiatives and efforts taken by Government of India through its various Science Ministries, Departments, and Funding Organisations. These organisations are continuously striving for combating the outbreak of COVID-19. These research-driven and technology-based interventions have been initiated on war footing to fight out the outburst of the pandemic.

The e-Newsletter aims to 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 Atmanirbhar.



For more information, visit:

<https://vigyanprasar.gov.in/covid19-newsletters/>

<http://www.indiascienceandtechnology.gov.in/covid-19-the-pandemic/newsletter-archive>

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

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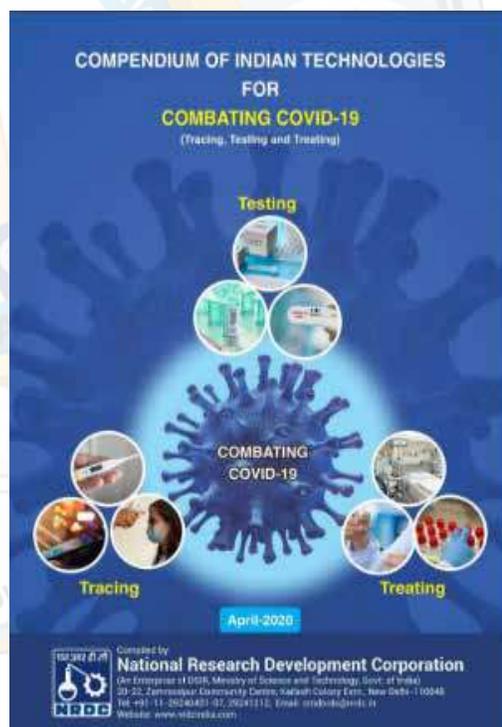
DEPARTMENT OF SCIENTIFIC &
INDUSTRIAL RESEARCH (DSIR) &
COUNCIL OF SCIENTIFIC & INDUSTRIAL
RESEARCH (CSIR)

NRDC brings out a Compendium of Indian Technologies for combating COVID-19

A “Compendium of Indian Technologies for Combating COVID-19 (Tracing, Testing and Treating)” prepared by National Research Development Corporation (NRDC) was launched by Dr Shekhar C Mande, Director General, CSIR and Secretary, DSIR, Government of India at CSIR Headquarters, New Delhi. The compendium carries information about 200 COVID-19-related Indian technologies, ongoing research activities, technologies available for commercialisation, initiatives and efforts taken by the Government of India, categorised under 3Ts of Tracking, Testing and Treating. Most of these technologies are proof-of-concept (POC) tested and can help the entrepreneurs to take the product to market faster as they do not have to reinvent the wheel. Dr Mande appreciated the initiative of NRDC for bringing out the Compendium of Indian Technologies for Combating COVID-19 by saying, “it is very timely and would benefit the MSMEs, Start-ups and the public at large.”

Website link:

<https://drive.google.com/file/d/1wTtuYtzGG5S3kKpIHgY6493pShIoHHjM/view>



Special issue of monthly e-Newsletter 'CSIR Samachar' on COVID-19

CSIR-Samachar is a monthly Newsletter published by CSIR-NISCAIR. The Newsletter consists of various contemporary activities. The April 2020 edition of CSIR Samachar focused on COVID-19 pandemic and efforts towards its mitigation.



Website link:

<https://www.niscair.res.in/periodicals/csirsamachar>

Special issue of monthly magazine SCIENCE REPORTER on COVID-19 by NISCAIR

Science Reporter is a monthly popular science magazine that has been published in India since 1964 by the National Institute of Science Communication and Information Resources (NISCAIR), New Delhi. It seeks to disseminate information about S&T developments throughout the world, with special focus on Indian scientific achievements. The magazine provides insight into all the major scientific and technological developments, presents facts about controversial scientific concepts and tries to bring to its readers interesting, exciting and informative information from various disciplines of science. In this moment of a grave health crisis due to outburst of the novel coronavirus, Science Reporter has brought out a special issue on various aspects of mitigating the COVID-19 pandemic.



Website link:

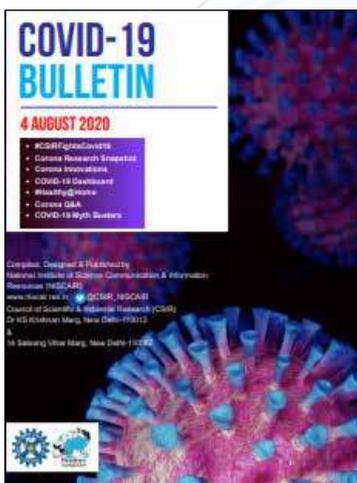
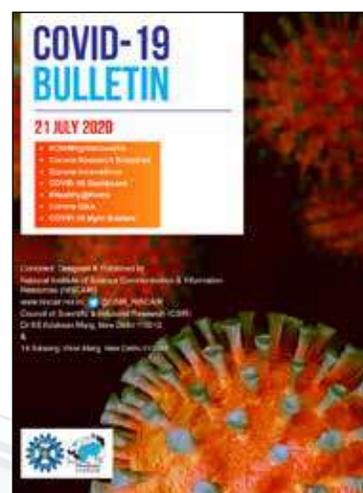
<http://nopr.niscair.res.in/handle/123456789/52957>

CSIR-NISCAIR brings out weekly e-Newsletter on COVID-19

National Institute of Science Communication and Information Resources (CSIR-NISCAIR) is bringing out a regular newsletter dedicated for the COVID-19 outbreak from May 2020. The newsletter covers stories and information on various aspects, like research, technology and innovation efforts to fight out the pandemic and related awareness and sensitisation information.

Website link:

<https://www.niscair.res.in/covidbulletin>

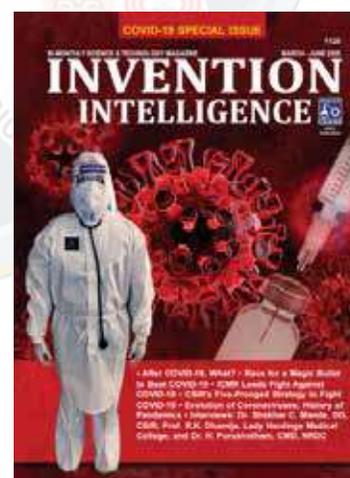


NRDC publishes special edition of 'Invention Intelligence' on COVID-19

National Research Development Council (NRDC), an enterprise of Department of Scientific & Industrial Research (DSIR), has published a special edition of its bimonthly S&T magazine 'Invention Intelligence.' The edition covers various aspects related to COVID-19 pandemic outbreak, like the unfolding new normal. The main objectives of the magazine are to disseminate information and create awareness about new technologies, inventions, innovations, IPR issues, etc. among the masses and foster the spirit of inventiveness, innovativeness and entrepreneurship among the students, scientists, technicians, budding entrepreneurs, etc. Invention Intelligence focuses on topics of current public interest and national importance relating to science, technologies, inventions, innovations and intellectual property rights.

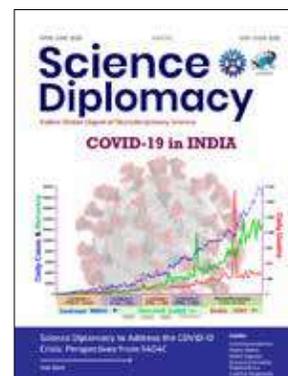
Website link:

http://www.nrdcindia.com/assets/vendor/filemanager/userfiles/Invention_Intelligence/ICovid19SpEdn.pdf



NISCAIR publishes a special edition of 'Science Diplomacy' on COVID-19

National Institute of Science Communication and Information Resources (CSIR-NISCAIR) published a special edition of 'Science Diplomacy' on COVID-19 in India in Apr-Jun 2020, Vol. 3(4). 'Science Diplomacy' is among the first endeavours to bring highlights of Indian scientific achievements in foreign languages. It helps in identifying priority areas for collaboration and involvement of stakeholders in policy-making and strategic engagements, including scientists, academicians, senior diplomats, science counsellors and experts.



In the current edition, perspectives from S4D4C have been covered along with the correspondence with scientists across the globe sharing their stories on COVID-19 global reverberations. S4D4C – the full project title 'Using Science for/in Diplomacy for Addressing Global Challenges' – is a European project, co-funded by the European Commission under the Horizon 2020 programme.

Website link:

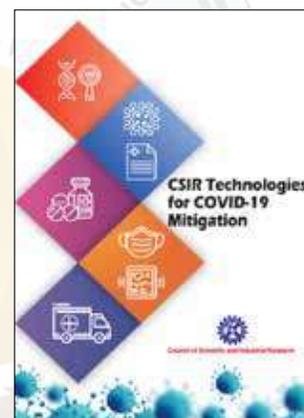
<https://www.niscair.res.in/includes/images/sciencediplomacy/Science-Diplomacy-April-June-2020.pdf>

CSIR comes up with a compendium on technologies for COVID-19 mitigation

CSIR has published a compendium on technologies for COVID-19 mitigation to provide an insight into the COVID-19 technologies developed by its organisations so far as well as to spur more innovations. With an 'Aatmanirbhar Bharat' high on its agenda, CSIR is eager to partner with more industries to take these technologies to the users although around 60% of technologies listed in this compendium have already been transferred to industry partners.

Website Link:

<https://www.csir.res.in/commonpdfpages/csir-technologies-covid-19-mitigation>



CSIR-COVID-19 blog platform

A blog has been created to disseminate information about the initiative taken against COVID-19 pandemic. Meaningful blog posts have been invited from CSIR community to be published on the CSIR-COVID-19 blog platform. Press Release/News/Updates/Articles related to COVID-19 could be found on this blog.

For more information: https://urdip.res.in/covid19/control?_nws

Videos showcasing CSIR's work on COVID-19

Videos are also being made about the activities of CSIR related to COVID-19, which are being broadcast through various media platforms. CSIR has created a video gallery on its website which shows the various dimensions related to the fight against the pandemic.

For more information: https://covid19csir.urdip.res.in/csir_video.jsp

Posters on COVID-19

COVID-19 Webinar Series in Indian Languages

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DEFENCE RESEARCH & DEVELOPMENT ORGANISATION (DRDO)

DRDO Newsletters enlist initiatives by its laboratories and establishments extending helping hand in fight against COVID-19

DRDO has been in forefront of fight against COVID-19 since its detection in India. The premier R&D organisation has innovated and configured many products required immediately to regulate the pandemic from its existing arsenal of technologies and knowledge.

A number of the products developed by DRDO to reinforce operations and to regulate spread of the infection are covered in their 4 recent newsletters. While DRDO labs are engaged in providing technological solutions and have developed variety of mitigation products many of its labs are engaged in providing help to local administration in combat against COVID-19.



For detailed information, visit
<https://www.drdo.gov.in/newsletter>.

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INDIAN COUNCIL OF MEDICAL RESEARCH (ICMR)

IJMR publishes its two special issues on COVID-19

Indian Journal of Medical Research (IJMR), a publication of ICMR, is a peer-reviewed online journal with monthly print-on-demand compilation of issues. The COVID-19 pandemic has created opportunities to build an improved response mechanism for future pandemics. Concerted, well-funded, comprehensive, planned, and all encompassing activities should facilitate building sustained institutional capacity to provide a swift and effective nationwide response to disease outbreaks. This could be done through access to appropriate technologies and improved logistics for efficient supply chains. These will also promote developing multi-sectoral stakeholder consortia at national and state levels to coordinate actions and launch a comprehensive whole-of-the-society

response to emerging infections. Overall

and long-term targets should be set to encourage and ensure convergence of all stakeholders for human health, animal health and environment to collaborate in implementing the One Health approach and protecting human life, reduce misery, and avoid damage to the national economy. These are doable actions. The national will and determination are vital to mitigate the severe impact of pandemics, such as COVID-19 in India. India's COVID-19 Containment Strategy has been aligned with WHO's Strategic Preparedness and Response Plan for COVID-19. During the ongoing pandemic, India could successfully and rapidly scale-up several important interventions.



Website Link:

<http://www.ijmr.org.in/showBackIssue.asp?issn=0971-5916;year=2020;volume=151;issue=2;month=February%20&%20March>

<http://www.ijmr.org.in/showBackIssue.asp?issn=0971-5916;year=2020;volume=151;issue=5;month=May>



ICMR appeals to the general public not to consume and spit smokeless tobacco in public areas

In view of the increasing danger of COVID-19 pandemic, ICMR appeals to the general public to refrain from consuming the smokeless tobacco products and spitting in public places. Chewing smokeless tobacco products (like Gutkha, Paan masala with tobacco, Paan and other chewing tobacco products) and areca nut (supari) increases the production of saliva followed by a very strong urge to spit. Spitting in public places could increase the spread of the COVID-19 virus.

Website Link:

https://www.icmr.gov.in/pdf/covid/techdoc/Appeal_to_the_General_Public.pdf

SCIENTIFIC ENDEAVOURS IN INDIA: EMERGENCE TO PANDEMIC

SCIENCE OUTREACH & POPULARISATION MINISTRY OF AYUSH

National repository of AYUSH COVID-19 clinical and other R&D initiatives

AYUSH Research Portal is aimed at disseminating the knowledge of AYUSH systems and the current research updates purely meant for academic purpose. In this portal users can search AYUSH terminology, research articles, journals etc. You can also search information on Ayurveda, yoga, naturopathy, Unani, Siddha, Homeopathy etc. and information about the clinical research, pre-clinical



research, drug research, and fundamental research. This initiative aims to collate the current research and clinical activities and updates related to the COVID-19 pandemic.

Website link:

<http://ayushportal.nic.in/Covid.aspx>

AYUSH Sanjivani app launched for inter-disciplinary studies involving Ayush interventions for COVID-19

The 'AYUSH Sanjivani' mobile app has been launched to help to generate data on acceptance and usage of AYUSH advocacies and measures among the population and its impact in prevention of COVID-19. It is developed by Ministry of AYUSH and MEITY and shall reach out to a target of 50 lakh people.



Website link:

https://play.google.com/store/apps/details?id=com.negd.ayushfeedback&hl=en_US

Government reaches to public through Ayush Sanjivani Pledge

Government of India has taken an initiative to reach out to general public through Ayush Sanjivani Pledge. Since immunity is playing a crucial role in transmission and acquiring of the COVID-19 infection, the Pledge initiative is aimed at sensitising the general public towards the adoption of safe and time-tested practices for immunity enhancement and disease prevention. The participants get the Certificate of Commitment after taking the pledge.

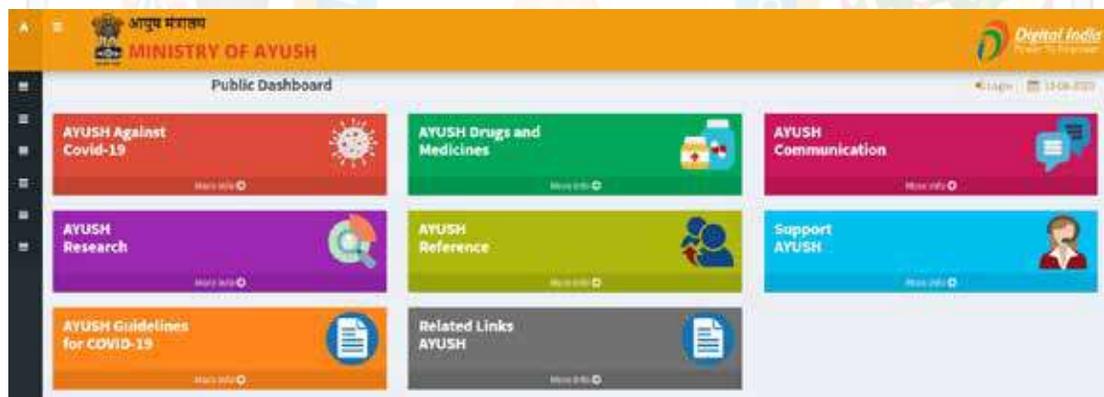


Website link:

<https://pledge.mygov.in/ayushsanjivani/>

COVID-19 dashboard developed by Ministry of AYUSH

Ministry of AYUSH developed a dedicated dashboard to provide real-time information on all COVID-19-related activities.



Website link:

<https://health.ncog.gov.in/ayush-covid-dashbaord/>

**SCIENTIFIC ENDEAVOURS IN INDIA:
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**INDIAN COUNCIL OF
AGRICULTURAL RESEARCH (ICAR)**

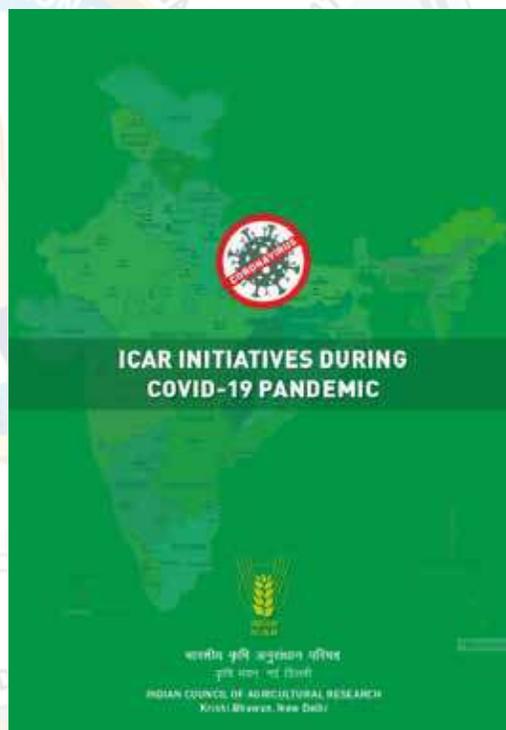
Activities undertaken by ICAR Research Institutes to mitigate farmers' problems during COVID-19 pandemic

The ICAR has tackled the challenges posed by COVID-19 pandemic to farmers and farming sector across the country in tune with the policy directions and guidelines issued by the Government of India to all or any of the States and Union Territories. It alerted the farmers and stakeholders across the country on the precautions, safety measures, and need for social distancing while completing the time-bound field operations like harvesting, post-harvest processing, storage and marketing of grains, fruits, vegetables, eggs, meat, and fish. It also issued an agro-advisory at the national level, which has been translated into 15 regional languages, widely circulated, and has received prime coverage in print, electronic and social media across the country.

ICAR has prepared state-wise agro advisories for farmers of the 29 states counting on prevailing crop stage and safety measures to be followed in various farm operations associated with standing crops and crops that are becoming ready for harvest. The advisories are going to be used for dissemination after translation in local languages through various print and electronic media and digital platforms by all stakeholders. This e-book captures the ICAR initiatives for supporting farmers and farming sector across the country in our endeavour to fight this pandemic by dovetailing safety measures with the time-bound agricultural operations to make sure health and wellbeing of our farming community and ensure food security through stability in production systems.

Website link:

<https://icar.gov.in/sites/default/files/eBook-COVID-19-ICAR-Initiatives.pdf>



ICAR comes up with an e-book on innovative agri-solutions during COVID-19

COVID-19 pandemic challenged many assumption of the fashionable life throughout the planet. The economies of major countries have come to a grinding halt. The challenge became still tougher because the lockdown resulted in shortage of farm labour on one hand and disruption of selling channels on the other. Items like poultry, dairy, fruit, and vegetables started perishing and this resulted into destruction of tons of food which otherwise would have been consumed. ICAR Agricultural Extension Network took the challenge and became proactive in devising and suggesting practical solutions to the affected farmers. There has been a really sizable amount of such innovative examples throughout the country which needed to be documented for subsequent emulation by the farmers and extension personnel. The urgency of delivering contents of this compilation to the beneficiaries at the earliest possible necessitated keeping the shape of this publication as an electronic one. The compilation of an electronic book on 'Innovative agri-solutions during COVID-19' is a crucial collection of unique samples of innovative actions and options suggested to the farmers.



Website link:

https://www.icar.org.in/sites/default/files/Innovative_Agri-Solutions_COVID-19-2020-1106.pdf



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