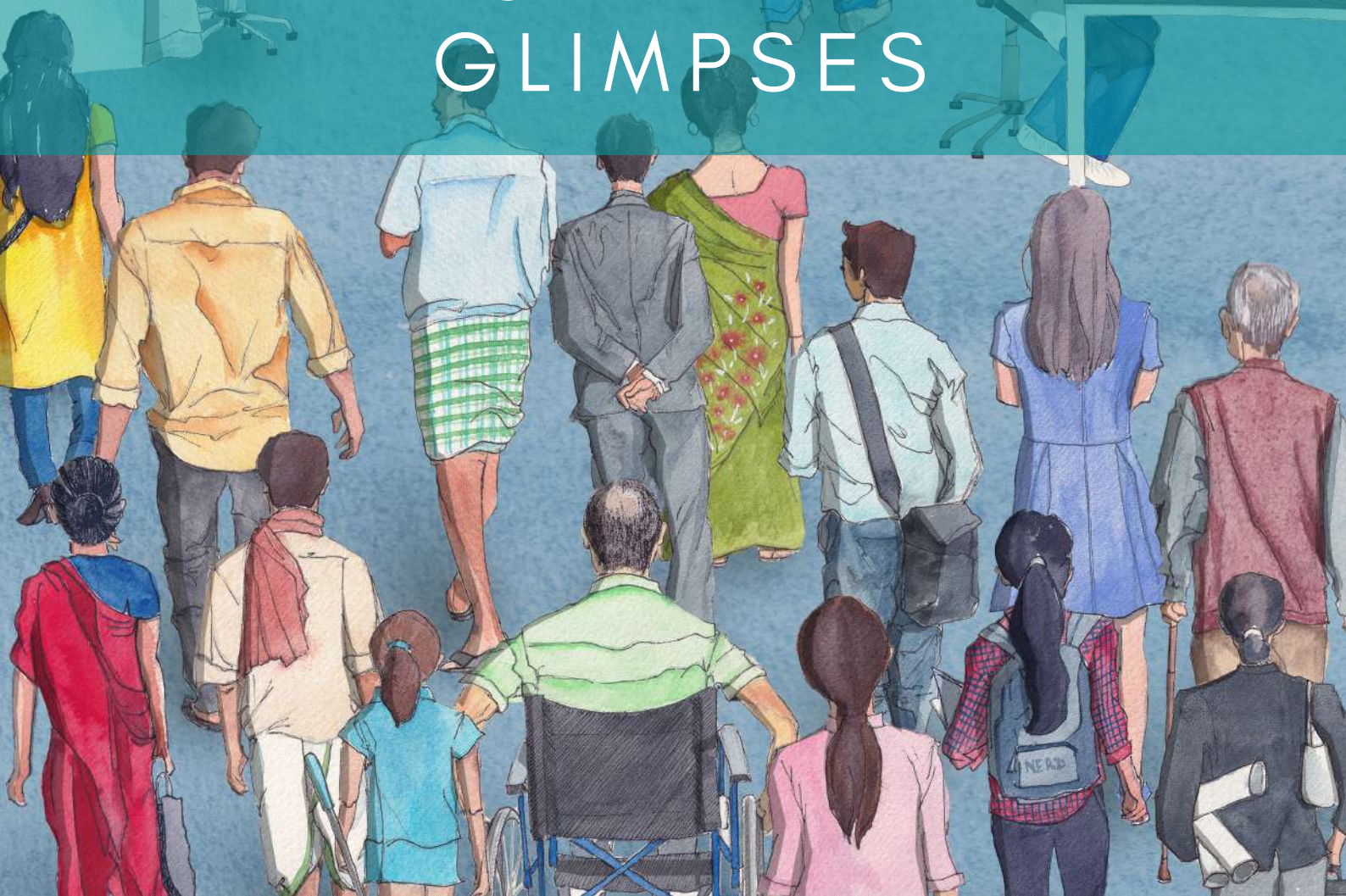


CSIR Fights COVID-19

GLIMPSES



CSIR Fights COVID-19

GLIMPSES



INNOVATE.IMPROVISE.IMPLEMENT

CSIR's COVID-19 Communication Team

Geetha Vani Rayasam, CSIR
Somdatta Karak, CSIR-CCMB
Atya Kapley, CSIR-NEERI
G Mahesh, CSIR-NISCAIR
M Chandrasekharam, CSIR-IICT
Abhay Bajaj, CSIR-NEERI
Hasan Jawaid Khan, CSIR-NISCAIR
Kollegala Sharma, CSIR-CFTRI

Artwork

Disha Chauhan

Six months ago, the COVID-19 pandemic unleashed many challenges upon the world. Scientists across the globe embarked on strategies and methods to handle the deadly virus and the pandemic-related problems. In India too, scientists from across various research, academic and medical institutions quickly rallied to find solutions.

Many CSIR laboratories work in the areas of drugs, vaccines, genomics, molecular biology and the like. In normal times, these laboratories would have pitched in and done their bit. However, difficult times call for different measures. At CSIR, we decided that a challenge of a global scale, and destructive potential needs an entirely different approach. We quickly decided to bring all the 38 laboratories on board and created five COVID-19 verticals which were need based. These 5 verticals - Surveillance, Diagnostics, Drugs & Vaccines, PPEs and Supply Chain Management - cut across laboratory specialisations.

In a true 'One CSIR' spirit, all the laboratories came together and worked in unison on a common problem. As the pandemic threw open many new challenges, be it unanticipated research problems, logistics limitations or short time frames they were addressed together

leaning on complementary and collective experience and wisdom. Hardworking and enthusiastic young scientists and researchers under able and liberal scientific leadership in the laboratories, researched, experimented, innovated and churned out over 100 technologies in the last 6 months.

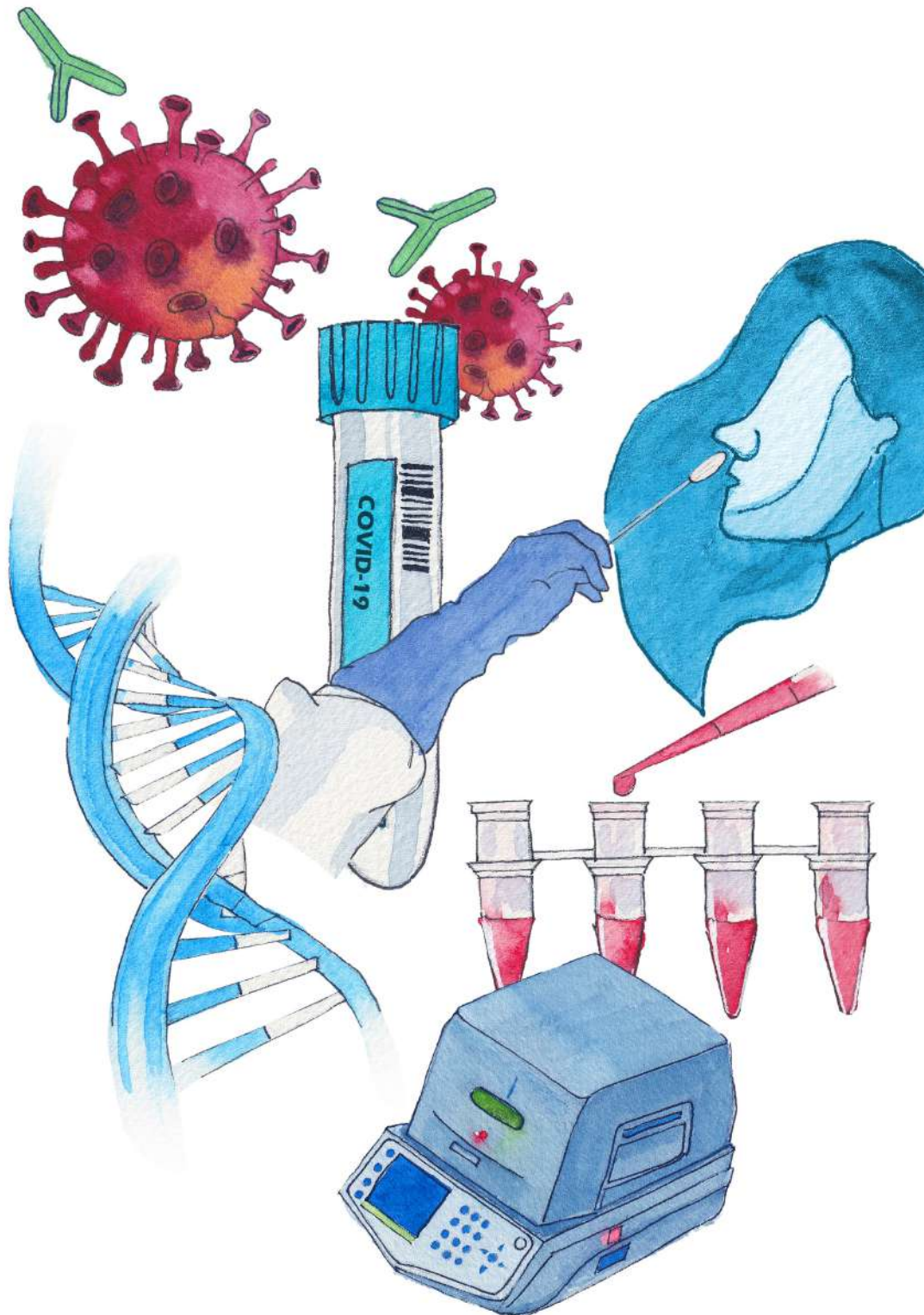
We are also fortunate to have received strong support from major industries, MSMEs and start-ups. The partnerships forged with industries really helped us to take our technologies and products to the market.

This book on CSIR's response to COVID-19 is an effort to convey the essence of the journey and not the entire journey itself. It is neither a detailed chronicle nor an account of our efforts as such an all-encompassing compilation will be very exhaustive.

As CSIR enters into its landmark 80th year, this compilation will serve as a reminder of what we accomplished in a short and the most challenging of times. Further, the readers of this digital book will get a peek into the spirit of CSIR and about some of our COVID-19 contributions. The hope is that it will serve as a template for facing future pandemics and calamities in times to come.

SHEKHAR C MANDE
DIRECTOR GENERAL-CSIR

CSIR labs trained, tested and developed new testing methods to fight COVID-19.



When COVID-19 struck India, we had already learned from experiences in other countries that testing and tracing will be the key to contain or at least slow down the spread of the coronavirus. The most imminent challenge in front of us was the number of testing centres in India that could prepare themselves for the purpose. The global gold standard of testing coronavirus has been RT-PCR, a standard technique that modern biologists perform. But not many hospitals in India have personnel who are trained to use RT-PCR. Additionally, the crisis also reflected in the scarcity of the few trained ones.

The foremost focus of CSIR's Diagnostic Vertical was to train human resources in hospitals, research centres and universities. Those from the hospitals needed to be trained on the diagnostic technique whereas those from research centres and universities had to be reinforced on the importance of biosafety regulations while working with an infectious agent. CSIR-CCMB in Hyderabad led the effort – trained people in person as well as online, first its own volunteers, and then those from other organizations. They made Standard Operating Protocols and training videos for testing centres, distributed these to various centres across the country.

CSIR-CCMB was the first non-ICMR research lab in India that started testing patient samples for COVID-19 with the volunteers it had trained. Telangana State Government's specific requests to the Centre probably catalysed this process. Soon, 11 more CSIR labs spread across the country started testing. Those that could not test supported the state government hospitals around them by providing them with infrastructure and human resources. The most important thing, however, was that we all realized it cannot be mundane testing at our labs. We had to identify the bottlenecks in

testing, and strategize solving them. We had to make the tests more scalable, accessible and cheaper. Some ideas were apparent to us, some were built on our expertise, and some came with collaborating and discussing with experts from other organizations.

CSIR-IGIB harnessed its capabilities in CRISPR-Cas9 technology, and quickly got onto developing a paper-based diagnostic test. With TATA Sons they now have DCGI approval to be used for testing. CSIR-IIIM started development of an isothermal PCR protocol that does not require sophisticated machinery. They are proceeding with Reliance Industries. CSIR-CCMB identified where samples can be pooled together for testing. This enabled testing 3.5 lac samples, and still counting in CSIR labs alone. The new one-step testing protocol developed by CSIR-CCMB, awaiting ICMR approval, is likely to make an immediate impact in COVID-19 testing.

While CSIR has risen to the occasion and already contributed in a prominent way in the Diagnostics Vertical, by leading from the front, a number of efforts that are still going on, viz., serological testing, rapid testing method, etc., are the indications that there is a lot more to come. Furthermore, we have learned a lot and have started thinking and planning how to handle such pandemics, perhaps in a much better way, in future. Our efforts in the area of air sampling/testing, and sero/sewage surveillance are clear indicators that CSIR has positioned itself to address the societal needs in public health crisis of this kind. CSIR's reach to industry partners and young innovators/start-ups has also come in bright colours in these testing times. And finally, our effort in indigenization of reagents and techniques of diagnostics will go a long way in serving the healthcare sector as well as the R&D efforts in public and private institutions in the country.

RAKESH K MISHRA
VERTICAL HEAD, DIAGNOSTICS



My experience with COVID-19 activities in CSIR-CCMB was nothing short of “phenomenal” because it changed the way that I see myself as a virologist. While accepting the task of coordinating the testing activity in CSIR-CCMB, I had no idea what I was going to face. However, the amazing coordination by various teams and well-oiled support machinery made sure that we could overcome all challenges that came by. It is very self-assuring to look back and realize that the little contribution that I made, changed the landscape of diagnostics in the entire research institution set up in India. I am really excited that we were the first research institution to start testing outside ICMR.

As a scientist studying fundamental aspects of virology, I often came across the dilemma of making direct societal contribution. COVID-19 provided a perfect platform for me to make this contribution real. Two key factors that helped us in the process are effective leadership and the support system. It is beyond anyone’s guess that we were totally unprepared for the kind of need. But we could quickly respond and stand up to the challenge. I hope the experience that we earned in the past six months would not be left to rot, and would be utilized in the long process that the nation is embarking upon in terms of setting up new research institutions to build grand capacities for our future needs.

Krishnan H Harshan
Principal Scientist
CSIR-CCMB

With research came along easier and more scalable testing techniques.

“

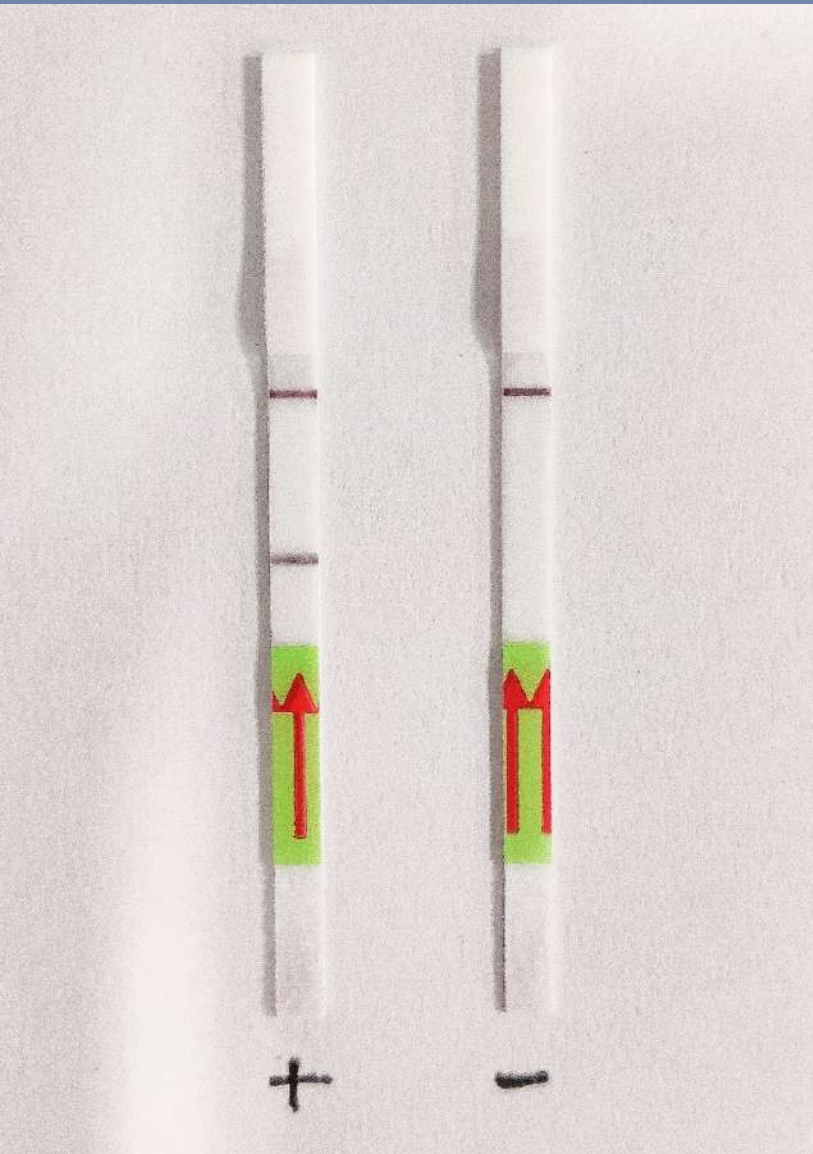
CRISPR-based diagnostics have been explored during the last two years since the discovery of Cas12/Cas13 proteins that exhibit trans-cleavage of reporter nucleotide sequences upon identifying with bona-fide targets. However, the COVID-19 pandemic has put such techniques under the radar due to the urgency of bringing in low-cost, fast turnaround diagnostics. Our challenge was to remain motivated as we faced the pressure of bringing an indigenous technique to address a health emergency in the shortest possible time frame. Maintaining high science, strong industry partnership and crossing regulatory hurdles have been the focus of the whole team consisting of exceptional students. We remain positive that FELUDA gives a significant boost to low testing rates in India, particularly in resource limited settings.

Debojyoti Chakraborty
Senior Scientist
CSIR-IGIB



“ Even a small idea can be the starting point for an impactful application when it is nurtured and supported in the appropriate environment. We had been working on genome editing when the COVID-19 pandemic presented an opportunity to tweak the tools we were developing. The timely re-design of a genome editing tool to a nucleic acid based detection method was rapidly converted to a marketable product only because of the support of colleagues and hard work put in by team members. Our institute complemented our efforts through steady support not only in the form of infrastructure but also by creating an environment of the utmost intellectual freedom and administrative agility.

Souvik Maiti
Senior Principal Scientist
CSIR-IGIB



“

Two years back, I started working with Dr. Chakraborty and he introduced me to a highly motivated student Mohd Azhar, already working on the principles of CRISPR based diagnostics. We both were saddened to witness the plight of affected individuals, when we went to sickle cell anemia camp in Raipur, Chhattisgarh, India. That particular drive affirmed my decision to contribute to creating a point of care, rapid and economical detection platform for such disorders that affects millions worldwide. Dated back to 28 January 2020 over a tea discussion, we decided to apply this similar strategy for diagnosis of widely spreading coronavirus disease. And, by the end of March, we successfully demonstrated its utility in COVID-19 which is famed as FELUDA.

Rhythm Phutela
PhD student
CSIR-IGIB

“ From the beginning of my research, I feel a bit inclined towards basic research & understanding the fundamentals of science. However, when I got involved in this project for developing CRISPR-based SARS-CoV2 detection kit, FELUDA, I learned the importance of both fundamental & application-oriented research going hand in hand. This is an example of a lab originated biochemical technique repurposed on demand for societal benefits. Of course, the satisfaction would only be when it ultimately reaches the market, to be used by the common public.

Manoj Kumar
PhD student
CSIR-IGIB



Tata Group

@TataCompanies



We're all set to put up a tough fight to [#COVID19](#).

The Tata CRISPR test, powered by [@CSIR_IND](#) and [@IGIBSocial](#), is the world's first diagnostic test to deploy a specially adapted Cas9 protein to successfully detect the virus. [#ThisIsTata](#) [#MakeInIndia](#)

The infographic features a dark blue background with a white and green border. The Tata logo is in the top right corner. The title 'Tata CRISPR' is in large white font. Below it, three bullet points describe the technology: 'India's first COVID-19 test using the CRISPR technology', 'Cost-effective and quicker than traditional RT-PCR tests', and 'Futuristic technology that can also help detect multiple other pathogens in the future'.

Tata CRISPR

- ▶ India's first COVID-19 test using the CRISPR technology
- ▶ Cost-effective and quicker than traditional RT-PCR tests
- ▶ Futuristic technology that can also help detect multiple other pathogens in the future

22:12 · 19 Sep 20 · [Twitter Web App](#)



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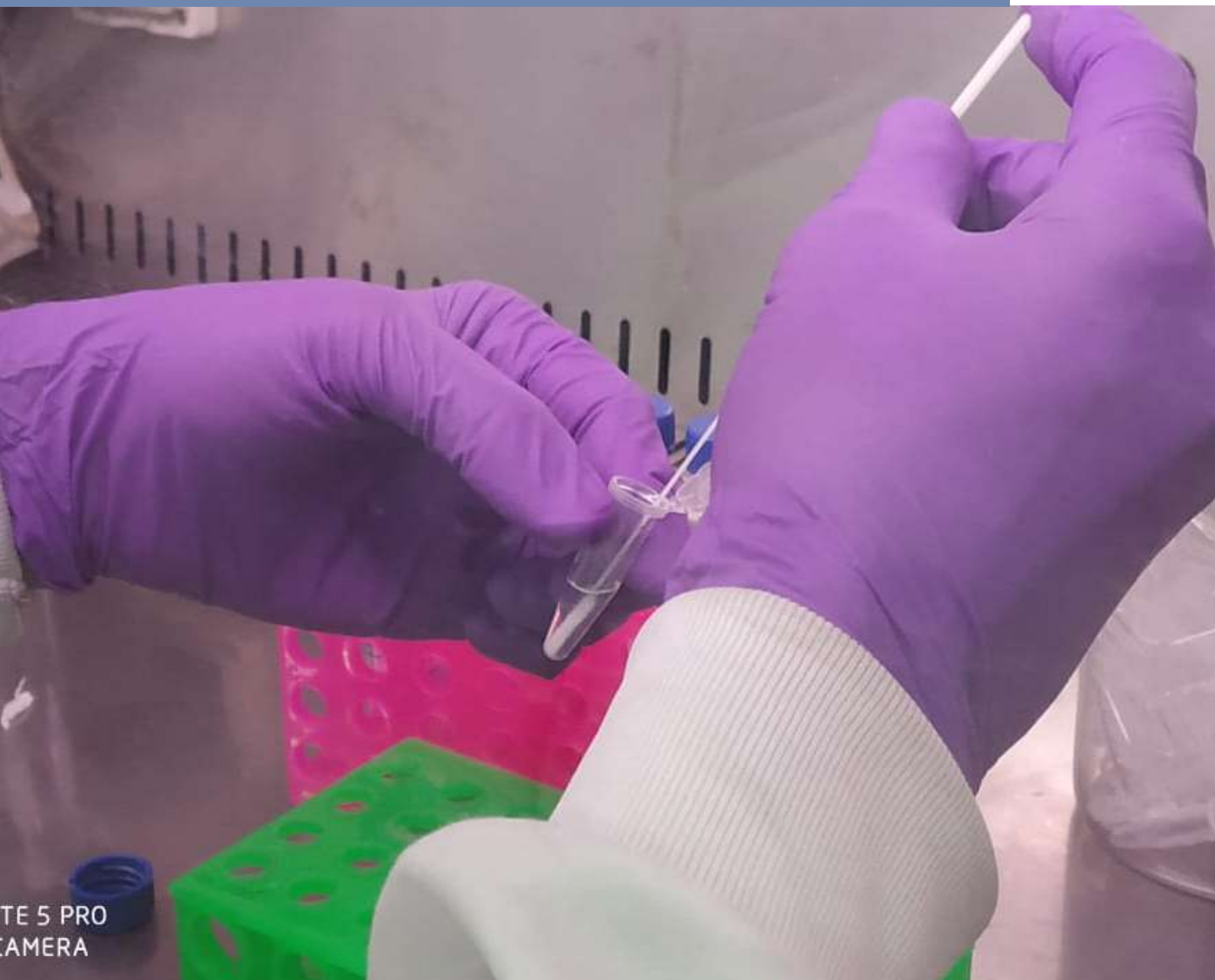


Sailing through unprecedented times needs a strong conviction to take up unconventional steps/solutions. COVID-19 is one such challenge which is bringing the best out of any

individual/institute. In a country like India, indigenisation is essential to cater to the needs of the country. I strongly believe that the current times is one such opportunity for any researcher/scientist to orient themselves with the societal needs, and contribute to the efforts in safeguarding our nation. I feel fortunate enough to be part of these efforts. Apart from being part of the regular testing I could also contribute to develop new ways of testing and also setup ways of doing community surveillance. The training I have received in the past has laid a strong foundation in thinking differently with a simplistic mindset, which has led to the development of an easier, faster, cheaper and safer way of COVID-19 testing (dry swab method).

This is not the first or the last pandemic, which mankind is witnessing, and therefore the science the scientific community does should be at the forefront and guide the policy makers, public and media to handle such challenges.

Santosh Kumar Kuncha
PhD student
CSIR-CCMB



“
With respect to my understanding and observations, significant contributions at CSIR-CCMB to develop new protocols and methods in a short time to fight COVID-19 are due to

1. Our culture, where students were given the opportunity to express and discuss ideas, which were implemented quickly to deliver better with the existing setup.
2. We were focused to utilize resources to the best of our abilities to deliver more in less time instead of waiting for new technologies.
3. The main factor which helped us to perform well is the quick collaboration of people with different skillsets to work for a dedicated cause.

Uday Sai Kiran
PhD student
CSIR-CCMB

“
1. The experiences are unfathomable. Many a times, when we reach a point of discovery or major development, we may not crisply remember the initiating moment of the whole journey. But our journey with COVID-19 was very different. Very vividly, we remember the discussions that our team had regarding the need for developments and the days we spent in working towards the same. A full-spirited work, with an aim to address a nation's crisis, resulted in the development of a need of the hour method.

2. Our strength is CCMB's years-long-built reputation and infrastructure, an encouraging environment to experiment, and similar minds available around us.

3. This situation revealed our true pace at which we could achieve a target and the extent to which we can extend our expertise. This pandemic has broken the (blurred) boundaries within science and showed that minds thinking different aspects of science can contribute to the same cause. This spirit, I believe, can bring out the true potential of science and a better future.

C G Gokulan
PhD student
CSIR-CCMB





We, at CSIR, started several programs to address the challenges posed by the COVID-19 pandemic. I held a virtual meeting with my scientists at IIIM and asked them to quickly submit project ideas with strict timelines and delivery schedules. Sumit Gandhi, one of our scientists, proposed the RT-LAMP assay for COVID-19 detection. Though we could certainly develop and optimize the protocols, for eventual large scale production of the kit, we required an industry partner. We already had collaborations with various industries, and Reliance Industries Ltd offered to partner for co-development of this kit. At times like this, we realize how much plasticity we have in the system, in terms of expertise; which is also much needed. Our scientists were quickly able to work on entirely new things and deliver.

Ram Vishwakarma
Former Director
CSIR-IIIM



Towards the end of March 2020, when we started working on the RT-LAMP diagnostic kit for COVID-19, there was a lockdown in the city. While most students were reluctant to come to the lab and work, two students: Ms. Vijay Lakshmi Jamwal and Mr. Natish Kumar soon joined the effort. It took quite some time to get certain reagents and primers shipped to Jammu during the country wide lockdown. This highlights the need for a stronger supply chain and logistics as well as the encouragement required for local industrial units, which can quickly supply basic reagents such as primers. Vocal for local!

Sumit G. Gandhi
Principal Scientist
CSIR-IIIM



Being a day scholar, during the strict lockdown in the city it was challenging to come to the lab. My family supported me and encouraged me to make my training in molecular biology useful to the country. This was an enriching experience as I was working on RT-LAMP diagnostic kit for COVID-19, which is very different from my PhD work. This involved a lot of new learning and experimentation. Further, working with industry, with strict timelines and interacting with my counterparts at RIL, made me aware how each one of us has a hidden potential, which we can call upon at times of need.

Vijay Lakshmi Jamwal
PhD Scholar
CSIR-IIIM



Since the initiation of the COVID-19 pandemic in India Reliance Industries Ltd (RIL) has been committed to participate in the battle against COVID-19 to provide solutions for COVID-19 mitigation in an India-centric and Make in India way. In this battle we got CSIR as our natural partner. An ideal academic-industry partnership between CSIR-IIIM, Jammu and RIL resulted in development of a COVID-19 detection kit (RT-LAMP kit) as a robust point of care diagnosis to the masses. As RIL's R&D and CSIR-IIIM, in a short span of two months, not only brought out an idea to reality but also in the process have displayed an example of seamless team work working with complete transparency, sharing resources and mutual recognition. I am sure this partnership with CSIR not only successfully will deliver the COVID-19 detection kit to the nation and but would take this partnership forward to develop and produce more indigenous products and technologies that can bring value to the masses, and make India proud.

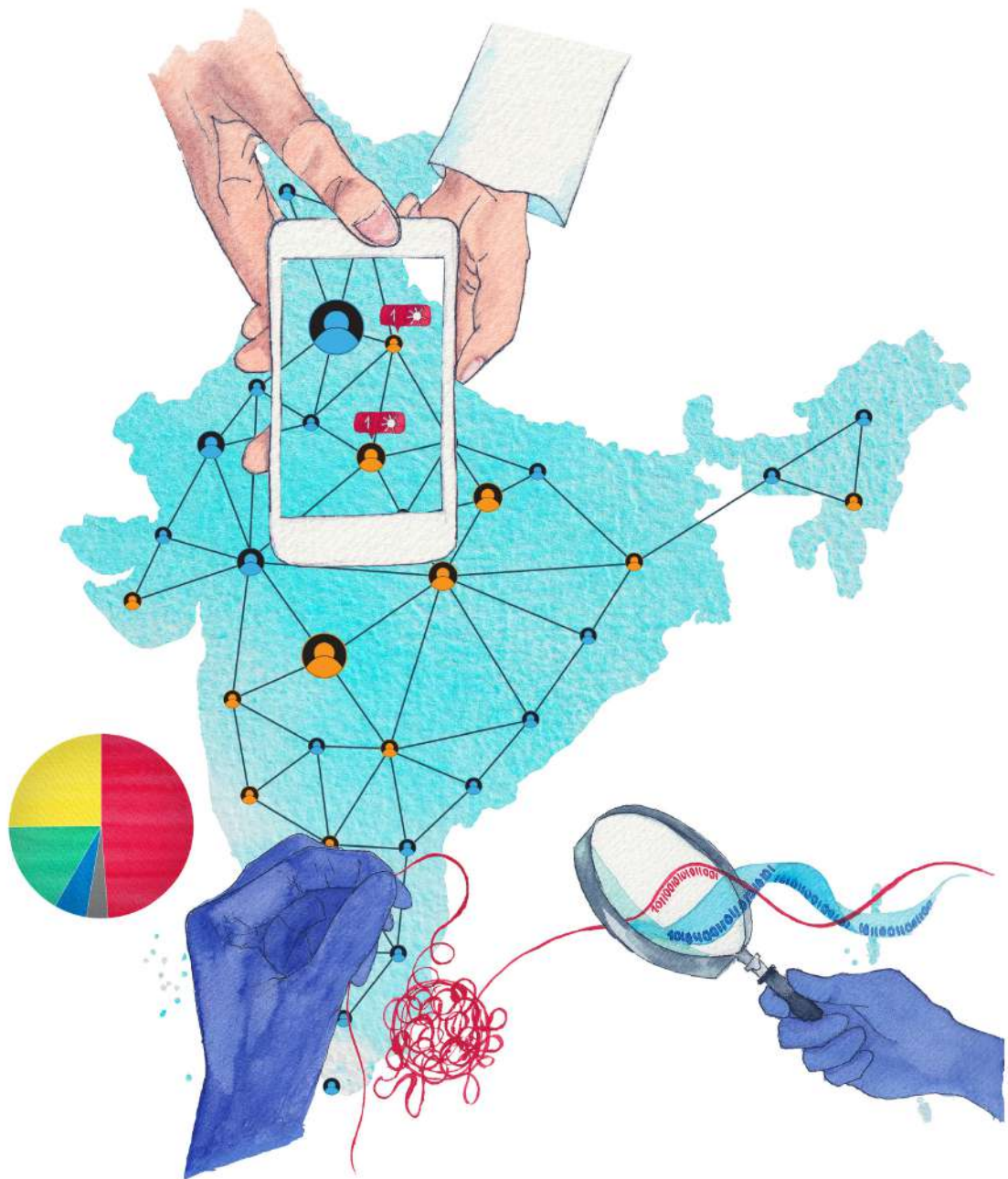
Santanu Dasgupta
Senior Vice President, R&D
Reliance Industries Ltd



The collaboration between RIL's R&D and CSIR-IIIM Jammu started two years back to develop therapeutic formulations. But it was during this pandemic that the partnership saw new facets of relationship and camaraderie to drive the bigger cause of COVID-19 mitigation, by developing COVID-19 detection RT-LAMP kit. We were quick to put up whatever was required in this war against COVID-19, melting all kinds of organizational boundaries, sharing all the possible resources and bringing in the best of our scientific and institutional acumen to the board. In doing so we were entirely driven by societal priorities, we faced unique logistical challenges, wherein the large and spread out RIL structure came in handy, further the procurements were exceptionally swift where the organizations came together, prioritized and eased their procedures to get the job done. These times would be etched in our memories as glistening examples of how people unknown to each other came together to drive productivity and accomplish defeat on the looming pandemic.

Manish Shukla
General Manager, A2O Group, R&D
Reliance Industries Ltd

From testing single samples,
CSIR developed techniques to test entire
cities and communities.



SARS-CoV-2 is an infectious virus and one of the critical steps in controlling the infections from spiraling is the ability to detect the infected at the earliest, and isolate them. Given India's huge population, testing every infection is a big challenge and presence of asymptomatic infections makes it even harder to detect the infected. The situation demands intelligent methods using digital tools and inexpensive and rapid tests that can help in tracing of infections. Hence, surveillance methods are essential that could help in tracing, identifying hotspots and preventing further spread. This led to the development of the Digital and Molecular Surveillance as one of the strategic verticals of CSIR.

This involves several approaches to tackle the spread of the SARS-CoV-2 strain of the virus:

1. Molecular surveillance that involved gathering information about the virus sequences
2. Developing surveillance methods for community-level screening
3. AI and digital tools
4. Serological and sewage surveillance

Molecular surveillance: This involves the identification of the strain of the virus and its sequence, which are critical towards understanding the molecular epidemiology. Sequencing viral genetic code will reveal information about the prevalent viral strains, pathogenesis, variants, and help researchers develop therapeutics, diagnostics, vaccines and better surveillance methods. It will help in understanding the origin of the infections, their spread in the community and their mutations spectrum. Since India is a geographically vast and diverse country, the virus samples have been collected from positive patients across the country. Whole genome sequencing project of the virus is being led by CSIR-IGIB, with support from other CSIR labs, viz., CCMB, IMTech, IICB and CDRI. So far, CSIR has sequenced more than 2000 SARS-CoV-2 genomes. Genomic analysis of the various genomes has been carried out and also tools like GEAR-19 have been developed for the same. The data

analyzed so far reveals that there are 7 clades in India with predominant clade being A2a and the distinct clade I/A3i is predominantly found in India.

In addition to sequencing, CSIR-IGIB and CSIR-CCMB aim to use high-throughput Next Generation Sequencing for detection of infections and genomic surveillance of SARS-CoV-2. CSIR-CCMB is working with Syngene and CSIR-IGIB is partnering with Illumina for implementing the megalab concept. These methods allow sequencing based diagnostics of thousands of samples at one go. The CSIR-IGIB has been one of the first labs globally to validate the COVIDseq protocol for detection of SARS-CoV-2 in clinical samples assay. Compared to RT-PCRs this assay could additionally provide invaluable insights into the genetic epidemiology of SARS-CoV-2 which would be potentially useful in molecular contact tracing for outbreaks and also understand the dynamics of spread of the infection.

Developing surveillance methods for community-level screening:

The second prong is to develop a model for community screening that can be replicated pan-India. It involves the collection of data of confirmed cases, suspected cases, probable cases, contact cases through contact tracing (that may include asymptomatic as well). The data generated is closely analyzed to interpret the spread of the disease and facilitate the government to take necessary action on a timely basis and mitigate community-level transmission. A pilot study of community-level screening was carried out at Kolar, Karnataka by CSIR-IGIB in collaboration with NIMHANS, THSTI (DBT), and TATA Sons. The study was undertaken when Kolar reported very few cases of the COVID disease and in the study, 1000 random samples that included 200 healthcare workers from a database of 1 mn people were screened by a mix of RT-PCR assays, rapid antibody test and ELISA techniques. The results of the study revealed that viral transmission had occurred despite no

known cases. Hence the strategy of 'Minimum Testing, Maximum Intelligence' coupled with the Aarogya Setu App intelligence will enable effective surveillance in communities.

AI and digital tools: This third prong empowers healthcare workers with artificial intelligence (AI) powered web based tools to fight COVID-19. CovBase was started with the aim of being a single national software platform where all clinical data of patients of COVID-19 would be stored and curated and eventually given to researchers to enable the rapid development of insights and tools to help in our war against COVID-19. All hospitals that are treating or will treat COVID-19 patients share the data which is curated by a team of experts into machine readable form and eventually shared with researchers to build insights and tools.

CovBase has three modules: the repository that will store all digital data that will be available to the researches for developing algorithm; AI module that will develop know-how on how to differentiate between symptoms; and a model for clinical evaluation. Using the CovBase and AI led to the development of a tool to screen chest X-rays for COVID-19 pneumonia. The algorithm underlying CovBase AI is trained to detect not only COVID pneumonia, but also atypical manifestations. CovBase has been developed in partnership with hospitals, industries and serves as valuable resource for validation of various digital tools developed for COVID-19 and CSIR-IGIB has undertaken various such validations. CSIR is also partnering with IIIT-Hyderabad, and INTEL towards comprehensive diagnostic testing and also risk stratification using AI and big data analysis.

Serological surveillance: Serological testing of communities for assessing the presence of antibodies against SARS-CoV-2 indicative of exposure and recovery from the virus is being used as surveillance tool. The SARS-CoV-2 serological surveillance is being carried out across many CSIR labs across the country to provide valuable information on COVID-19 disease as a part of the CSIR Phenome India Project. The Phenome project is a long-term longitudinal observational cohort study of health outcomes within CSIR employees with an aim to develop risk prediction tools and play an important role towards establishing precision health and medicine for the Indian population.

Sewage surveillance: New ways of surveillance for detection of SARS-CoV-2 in sewage which gives an early indication of virus spread and helps in implementation of appropriate measures is being carried out by CSIR labs. Samples are collected from sewage treatment plants and analyzed for presence of the virus and has been undertaken by CSIR-CCMB, CSIR-IICT, CSIR-NEERI among many others.

The implementation of the various surveillance methods periodically in communities will guide the strategy to implement suitable containment and opening measures and mitigate the spread of SARS-CoV-2. Further, the multiple surveillance platforms set up will help not only in the current pandemic but will also ensure preparedness for future pandemics.

ANURAG AGRAWAL
VERTICAL HEAD, DIGITAL AND
MOLECULAR SURVEILLANCE



Loading and testing coronavirus genome samples for sequencing



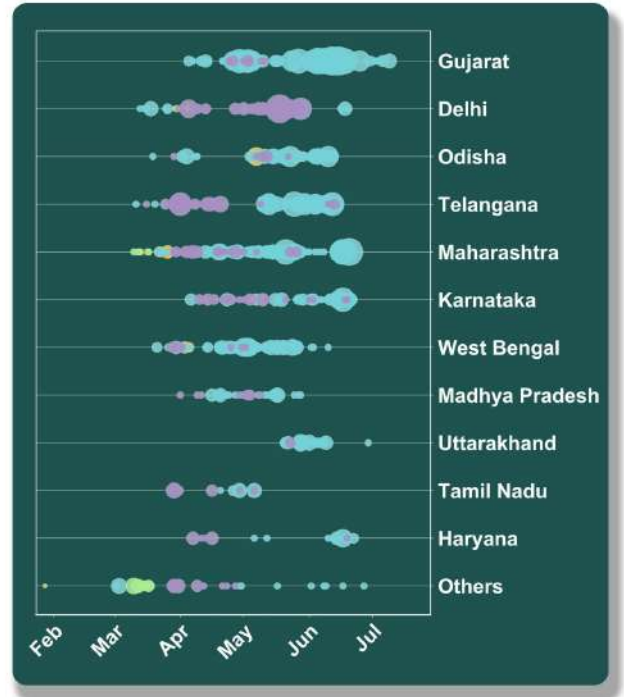
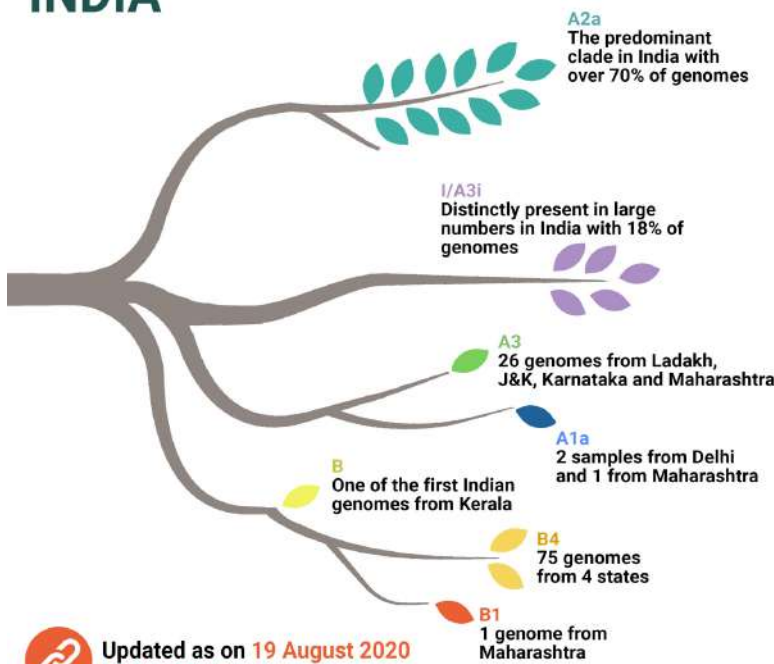
Until late March, the Next Gen Sequencing facility at CSIR-CCMB has mostly been processing human and other large mammalian genomes, and occasional invertebrates - the smallest genome we had sequenced till then was a few bacteria. So when we were tasked with sequencing the SARS-CoV-2, it was virgin territory for all of us. Thanks to the diverse team of student volunteers who stepped up for the job, and a matching level of support from our technical staff running the facility, we could generate and analyze the data two weeks after we started. Countless PCRs abound, I remember excitedly waiting for gels to finish running to see if the bands are there – something that I haven't done since my PhD days. The entire ordeal, though hectic and stressful, was a fascinating and memorable journey for me, and I am stoked to have contributed to the fight against this pandemic. However, it wasn't without hiccups. The strategy had to be optimized for consistency and quality, and there were restrictions in procuring new consumables due to national lockdown. It was the unwavering, tireless efforts of the team of volunteers and my students that took us to success, and I thank them from the bottom of my heart for delivering quality output in record time – a trait that CCMB always takes pride in.

Divya Tej Sowpati
Scientist
CSIR-CCMB



DIVERSITY OF SARS-CoV-2 IN INDIA

The phylogenetic tree was built using Nextstrain and the dataset of over 2000 viral genomes from India downloaded from GISAID



Updated as on 19 August 2020
bit.ly/c19phylovis



Kiran Mazumdar-Shaw @ki... · 16h

Scientists @ccmb_csir have studied more than 2,000 SARS-CoV-2 genomes from India to find that the I/A3i clade strain has dropped from 41% to 18%, while the A2a clade, associated with increased infectivity, has increased & at present infects 70% Indians



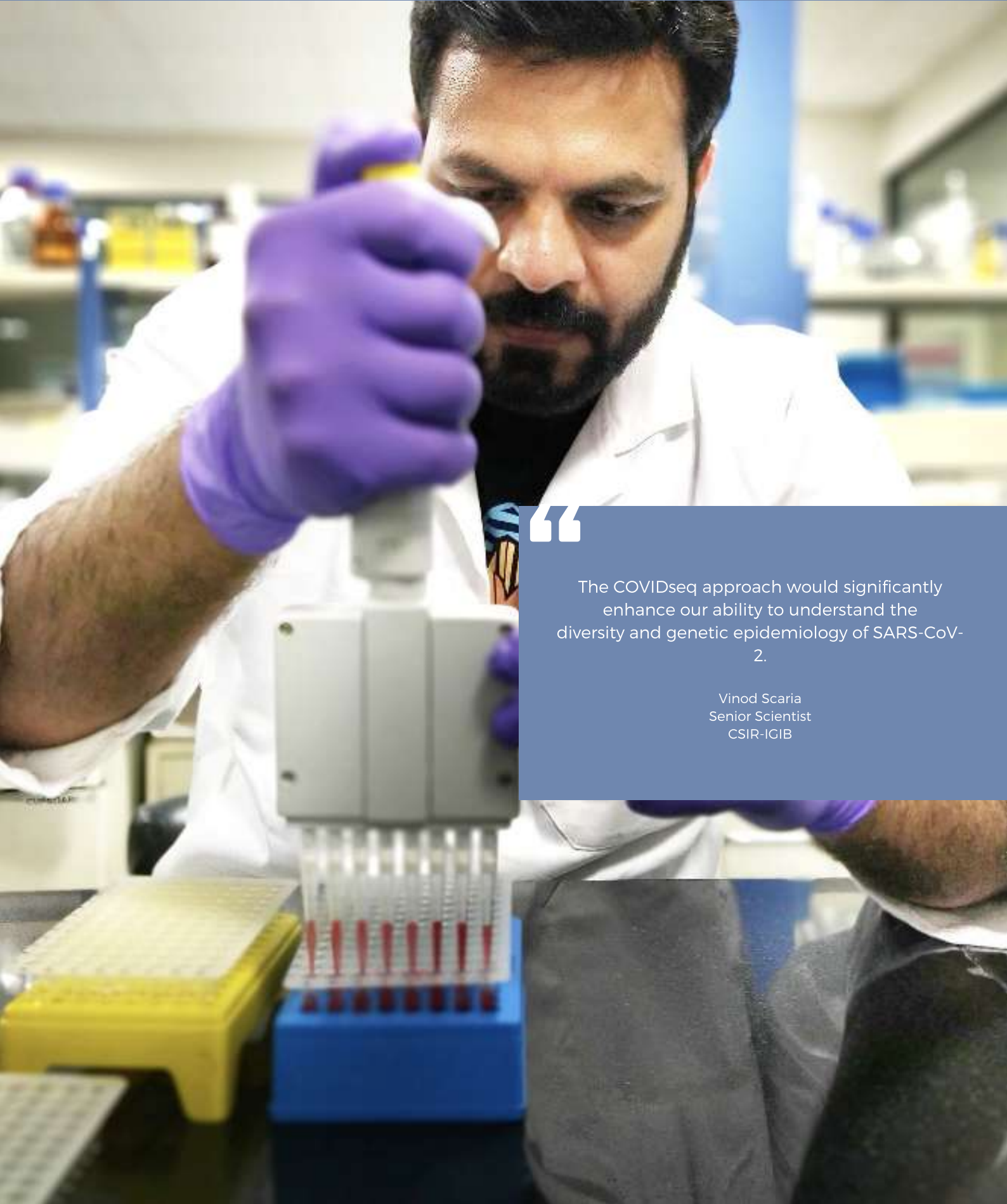
Scientists analyse 2,000 coronavirus genomes from India: The genomic I...
indiatoday.in

17 65 291



The COVIDseq provides the much-needed scalability to fight this pandemic and has the potential to expand India's COVID-19 testing capacity”

Sridhar Sivasubbu
Senior Principal Scientist
CSIR-IGIB



The COVIDseq approach would significantly enhance our ability to understand the diversity and genetic epidemiology of SARS-CoV-2.

Vinod Scaria
Senior Scientist
CSIR-IGIB



Nivruti ✓
@rnivruti



Very honored to be working with @AnuragAgrawalMD @shekhar_mande & @iiit_hyderabad to bring leading technologies like #AI, #Genomics, #Analytics for #diagnosis #precision-health and #risk-stratification. Tech in health is #1 in my mind for #India & #World! @intel @rsprasad @KTRTRS



Anurag Agrawal @AnuragAgraw... · 12 Aug

Next - building fully automated NGS megalabs. These will be dual use, catering to human genomic needs such as #RareDisease, precision health, as well as creating surge capacity for pathogen diagnostics and pande...

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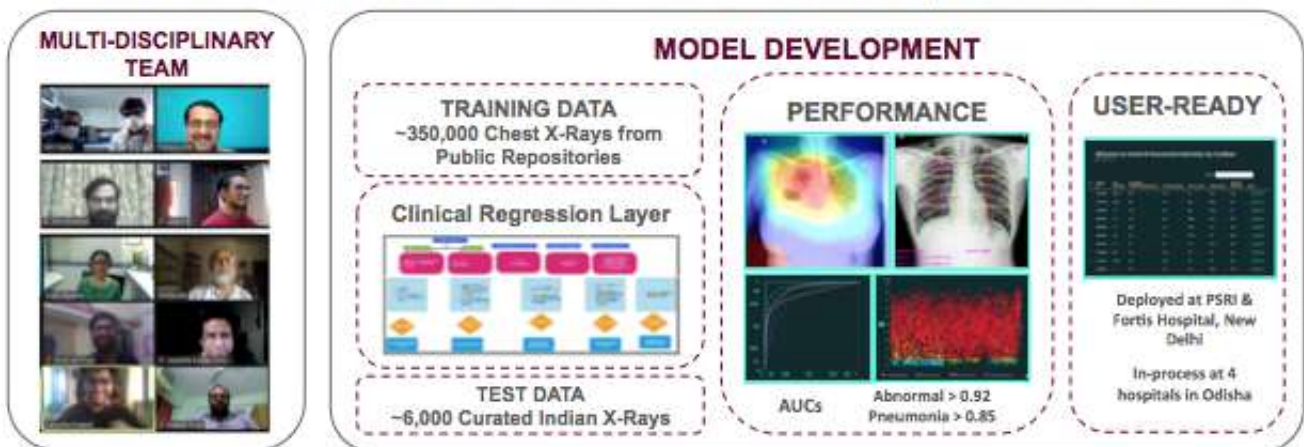
13 Retweets 1 Quote Tweet 90 Likes



29

AI Solution for Chest X Ray in COVID-19

Cov.Base: A Consolidated Databank of clinical & molecular information of patients of COVID-19 in India



Cov.Base



Shekhar C. Mande

#CSIRFightsCOVID19

September 22, 2020



Collection of sewage samples that contain non-infectious samples of viral RNA from large parts of the city (picture above), and testing in labs (picture below)



Collection of blood samples from employees across CSIR labs as a part of Phenome India project



The interesting aspect of a CSIR cohort is that it would be fairly representative of a spectrum of middle class India. We could give them smart watches or other devices that can track health parameters and we will track variations in specific genes, known to be correlated to certain diseases, that can help predict the likelihood of disease.

Anurag Agarwal
Director
CSIR-IGIB



This project with the current scale, given a few years time is bound to give priceless data on health - and of people across the country. A major step in the Indian health scene.

Shantanu Chowdhury
Senior Principal Scientist
CSIR-IGIB



It is the first time a pan-India study of this magnitude is being conducted, and this is going to tell us a lot of things about how diverse lifestyles and environment affect health across the country. I believe that it has potential to highlight the importance of personalised medicine that will lead to a new, healthier India.

Shantanu Sengupta
Senior Principal Scientist
CSIR-IGIB

COVID-19 asked for medicines urgently
with limited options to import.



In the initial stages of the COVID-19 pandemic caused by the new coronavirus (SARS-CoV-2), there were no drugs or vaccines available to treat the disease, and developing any new drug would take more than 10 years. In view of this global health emergency, time was crucial to save lives and globally, multipronged efforts started to fast-track and repurpose the drugs approved or in clinical trials for other viral diseases such as influenza, hepatitis, HIV or Ebola, against COVID-19. In India, CSIR commenced work through identification of drugs for repurposing/repositioning, vaccines for repurposing and AYUSH products to counter the pandemic. In six months, India has a treatment regimen in place to treat people affected with COVID-19. Some of the drugs identified for repurposing for the treatment of COVID-19 included Hydroxychloroquine, Azithromycin, Remdesivir, Lopinavir, Ritonavir, Umifenovir, Oseltamivir, Azvudine, Favipiravir and Darunavir.

Many CSIR institutes along with industry partners worked towards developing synthetic processes and repurposing of such drugs. As a result CSIR successfully repurposed Favipiravir and Remdesivir. CSIR-IICT developed a technology for Favipiravir with indigenous raw materials while industry partner, Cipla, launched the drug in the market as Ciplenza. This partnership ensured the drug was available at an affordable price in the Indian market.

India was one of the first countries in the world after UK, where Remdesivir was synthesised and made available to the market in a very short time after Gilead granted voluntary license for its manufacture mainly due to the efforts of CSIR-IICT, which developed a process using indigenous raw materials that aided pharma companies to release the product in the market without any delay. Today, in India, five pharma companies are meeting global demand for Remdesivir.

CSIR-IICT succeeded in the backward integration of the Hydroxychloroquine (HCQ) process by developing key starting materials

required for the process. CSIR and Sun Pharma jointly developed phytopharmaceutical ACQH, a formulation for dengue being repositioned for coronavirus. Sun Pharma is doing the clinical trials for ACQH in collaboration with DBT-ICGEB and CSIR-IIIM.

CSIR-IIIM also accomplished the synthesis of Favipiravir and gram level scale up has been demonstrated to the industry partner M/s Anphar Pharma, Jammu. CSIR-IIIM and Anphar Pharma have signed a MoU for the technology transfer of this drug. CSIR-IIIM is working on synthesis of some selected APIs such as Ribavirin, Niclosamide, EIDD-1931, Remdesivir fragment - in collaboration with CSIR-IICT, and Nafamostat. These syntheses are helping in producing the drugs in our country in a short time after receiving appropriate approvals.

CSIR-CDRI developed an economically viable technology to manufacture of Umifenovir in a record time and transferred the technology to Medizest Pharmaceuticals Pvt Ltd, Goa. CSIR-CDRI also developed improved processes for Niclosamide and Nitazoxanide while an optimization of synthetic route for Baloxavir, EIDD 2801, PB-28 and Galidesivir are underway. CSIR-CDRI has received permissions for carrying out Phase III randomised, double blind, placebo-controlled trial of efficacy, safety and tolerability of antiviral drug Umifenovir while clinical studies for Niclosamide and Nitazoxanide are under progress.

In yet another effort CSIR-IICB developed an affordable process for Tilorone dihydrochloride and is developing a cost-effective process for the synthesis of Baloxavir. CSIR-IICB is actively involved in developing combination therapy for the treatment of COVID-19 using Tilorone-Arbidol and Tilorone-Roflumilast combination. Tilorone is a host targeting drug whereas Arbidol and Roflumilast act as antiviral and PDE4 inhibitor agents respectively.

CSIR and Ministry of AYUSH have joined hands to validate some of the traditional AYUSH

formulations, and their efficacy through scientific evidence. Following an MoU with CCRAS, New Delhi, CSIR-IIIM is validating a few formulations such as *Withania somnifera* (Ashwagandha), *Tinospora cordifolia* + *Piper longum* (Guduchi + Pippali), and *Glycyrrhiza glabra* (Yashtimadhu).

CSIR is evaluating the safety and efficacy of Mycobacterium W (Sepsivac) in critically ill, hospitalized and high-risk patients along with the industrial partner M/s Cadila Pharmaceuticals Ltd, Ahmedabad. PGIMER, Chandigarh, AIIMS at New Delhi, Bhopal and Raipur are participating in the clinical trials for repurposing the Mw vaccine. The Phase 2 trial on Sepsivac has been successfully completed and Phase 3 trial will begin soon.

Supplements is another area of work, where CSIR developed products such as Zinc gluconate and Vitamin C as nutraceutical. A fermentation-based technology for production of various Zinc gluconate was developed for more bioavailability. Capsule as well as syrup formulations for natural vitamin C and Zinc gluconate (ZINCONA-C) have been successfully developed.

CSIR is also actively involved in conducting plasma therapy as an alternative to combat COVID-19 in collaboration with Calcutta Medical

College and Infectious Disease Hospital, Belegata, Kolkata. A Dedicated 'Epidemic Immune Monitoring Lab' has been prepared for this program, and the clinical trial has been approved by DCGI.

CSIR-CCMB and Bharat Biotech are working together for inactivated coronavirus vaccine development under the aegis of CSIR-NMITLI Program. In order to take forward new drug discovery, a critical step is the establishment of viral cultures and assays for testing. CSIR-CCMB has made considerable progress towards that and all the identified small molecules, natural products and phyto-pharmaceuticals are being tested. This cell based viral cell culture system established initially by CSIR-CCMB and later by CSIR-IMTech is also helping in vaccine design and validation in partnership with Industry.

Through various interventions, CSIR is making all efforts to mitigate suffering of people from the pandemic. In less than 100 days, various CSIR labs reached the Indian public through repurposed drugs and technologies to help people cope with the pandemic. CSIR through its efforts has demonstrated to the world that India is capable of indigenously working towards solutions to combat the pandemic in a short time.

SRIVARI CHANDRASEKHAR
VERTICAL HEAD, DRUGS AND VACCINES



Since early February (looking at the virus situation in China), we at the CSIR-IICT have been studying the literature on drugs that were developed for treating influenza, Ebola and other virus-related infections that had affected many parts of the globe. After identifying few molecules for repurposing, quick progress was achieved through molecular modeling. The central idea of the work was to develop processes that would work with the local chemicals available. In these times of pandemic, it is difficult to source raw materials for APIs from other countries. And for our country, we wanted to develop a process that would be cost-effective. That means the cost of the drug would be much less in the market

Raji Reddy
Senior Principal Scientist
CSIR-IICT



The APIs for Favipiravir and Remdesvir and other molecules identified were complex. The most challenging part was to source raw materials for the key starting materials. We worked day and night to develop the process. With the support of our team and staff we could develop an effective process for both these drugs. The process was transferred to the industry to reach the market in a short period of time.

Prathama Mainker
Senior Principal Scientist
CSIR-IICT



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To address the urgent need to combat the ongoing outbreak of COVID-19 caused by the novel coronavirus SARS-CoV-2, we at CSIR-IICB have developed a cost effective and industry friendly process for Tilorone dihydrochloride and its intermediates, and we are looking for industry partner. CSIR-IICB is also actively involved in developing the cost effective process for the synthesis of Baloxavir, an anti-viral drug.

Indu Bhusan Deb, P Jaisankar, Ranjan Jana
Principal Scientists
CSIR-IICB



“

CSIR's New Millennium Indian Technology Leadership Initiative (CSIR-NMITLI) has been encouraging innovation in the country by supporting and synergizing the publicly funded R&D institutions, academia and private industry. Under the aegis of NMITLI, Cadila Pharmaceuticals Ltd., Ahmedabad has developed a drug called-Sepsivac, for saving lives of critically ill patients suffering from Gram-negative sepsis. Currently, during the COVID-19 pandemic, with NMITLI support, Sepsivac is being repositioned for COVID-19 patients. It has recently completed the phase 2 clinical trial on critically ill COVID-19 patients, and Phase 3 trial will be initiated shortly.

Rajendra Prasad Singh
Head, Innovation Management Directorate
CSIR



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For the last two years, I have been working at CSIR-IICT in the process development of API molecules. I am very lucky to work in a CSIR laboratory with excellent facilities. During the COVID-19 pandemic, our team worked day and night in the lab to successfully develop processes for repurposing drugs, Favipiravir and Remdesivir. The successful synthesis of the drugs in cost-effective manner was achieved mainly due to great cooperation in our team. The developed technology was transferred to the pharma companies to manufacture the drugs at a large scale.

Ramachandra Reddy
Research Associate
CSIR-IICT

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N4-Hydroxycytidine (NHC) is a Cytidine analogue that has demonstrated potent, broad-spectrum activity against COVID-19. In literature there are only two patented methods available for the synthesis of NHC where the authors reported only hydroxylation of Cytidine and Uridine in cryogenic reaction conditions. Unavailability of starting materials in bulk in india, avoiding of cryogenic reaction conditions, make the drug affordable and our interest in nucleoside chemistry led us to synthesize the desired drug. So that it might be available in cheaper rates in india in near future.

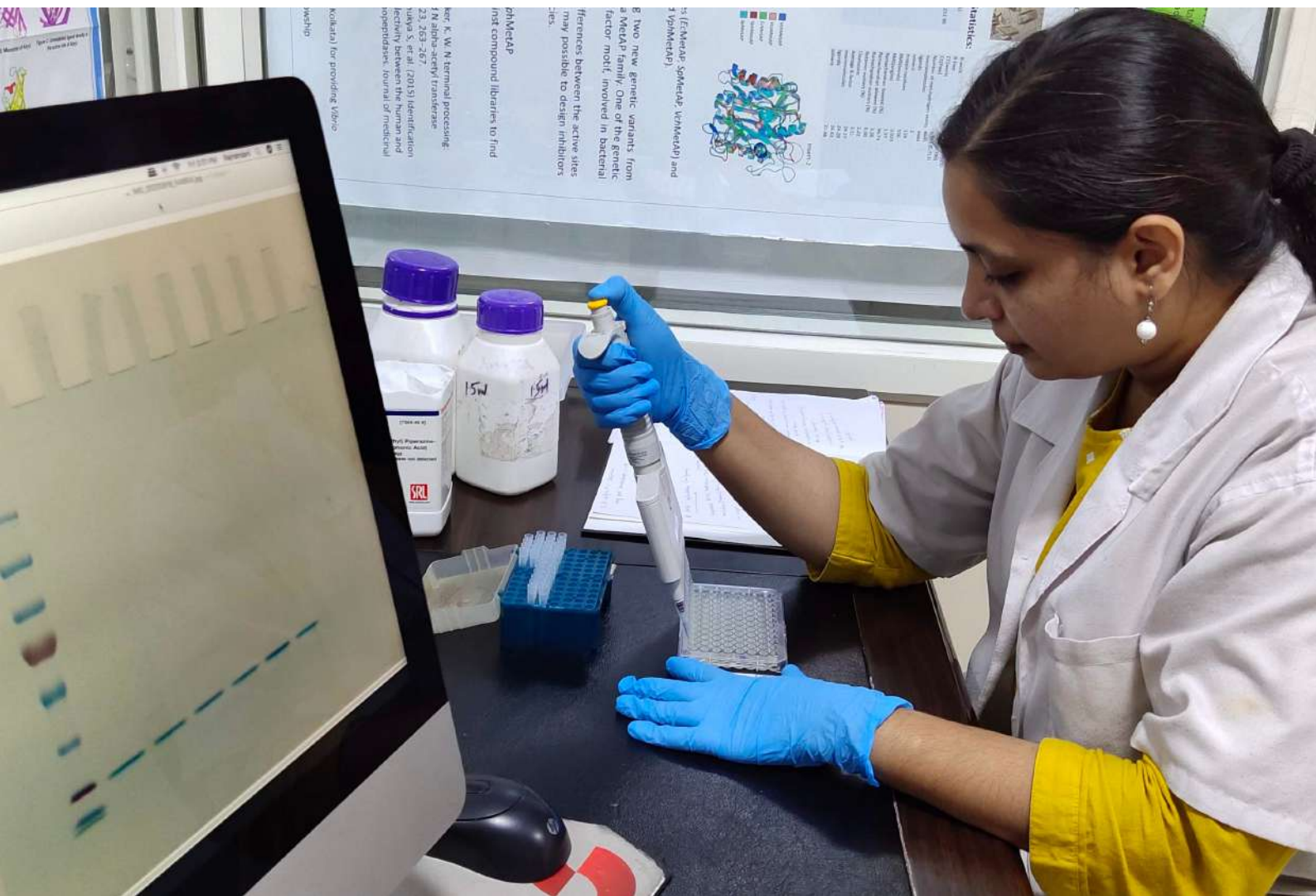
Ajaz Ahmed
CSIR-SRF
CSIR-IIIM



“

Immediately after the outbreak of COVID-19, CSIR-CDRI carried through discussions to meet the demand of antivirals, specially targeting the host proteins so that a preventive as well as curative drug can be developed. In this line, a dedicated team worked on war footing to develop the effective processes of Umifenovir, Niclosamide and Nitazoxanide with necessary clinical trials.

Ajay Kumar Srivastava
Senior Principal Scientist
CSIR-CDRI

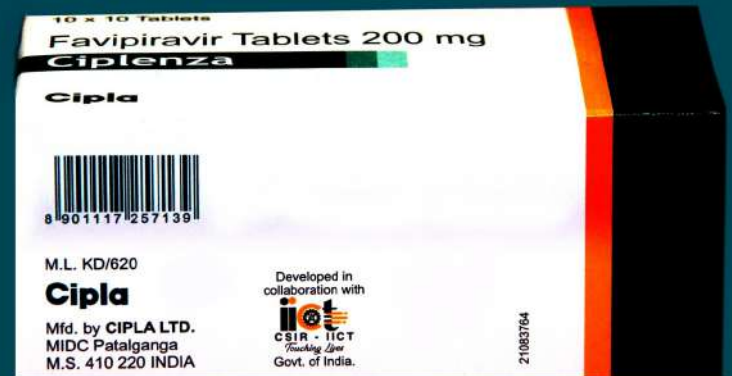




The regulatory approval by DCGI to conduct phase 2 clinical trial of the new phytopharmaceutical candidate ACQH (developed by Sun Pharma in collaboration with DBT-ICGEB and CSIR-IIIM) on COVID-19 patients as an important milestone. Since the notification of phytopharmaceutical drug in 2015 as a new class of modern drugs to be regulated by DCGI, this SunPharma-DBT-CSIR partnership sets the stage for developing new medicinal plants based therapeutics in India

S S Handa
Former Director
CSIR-IIIM



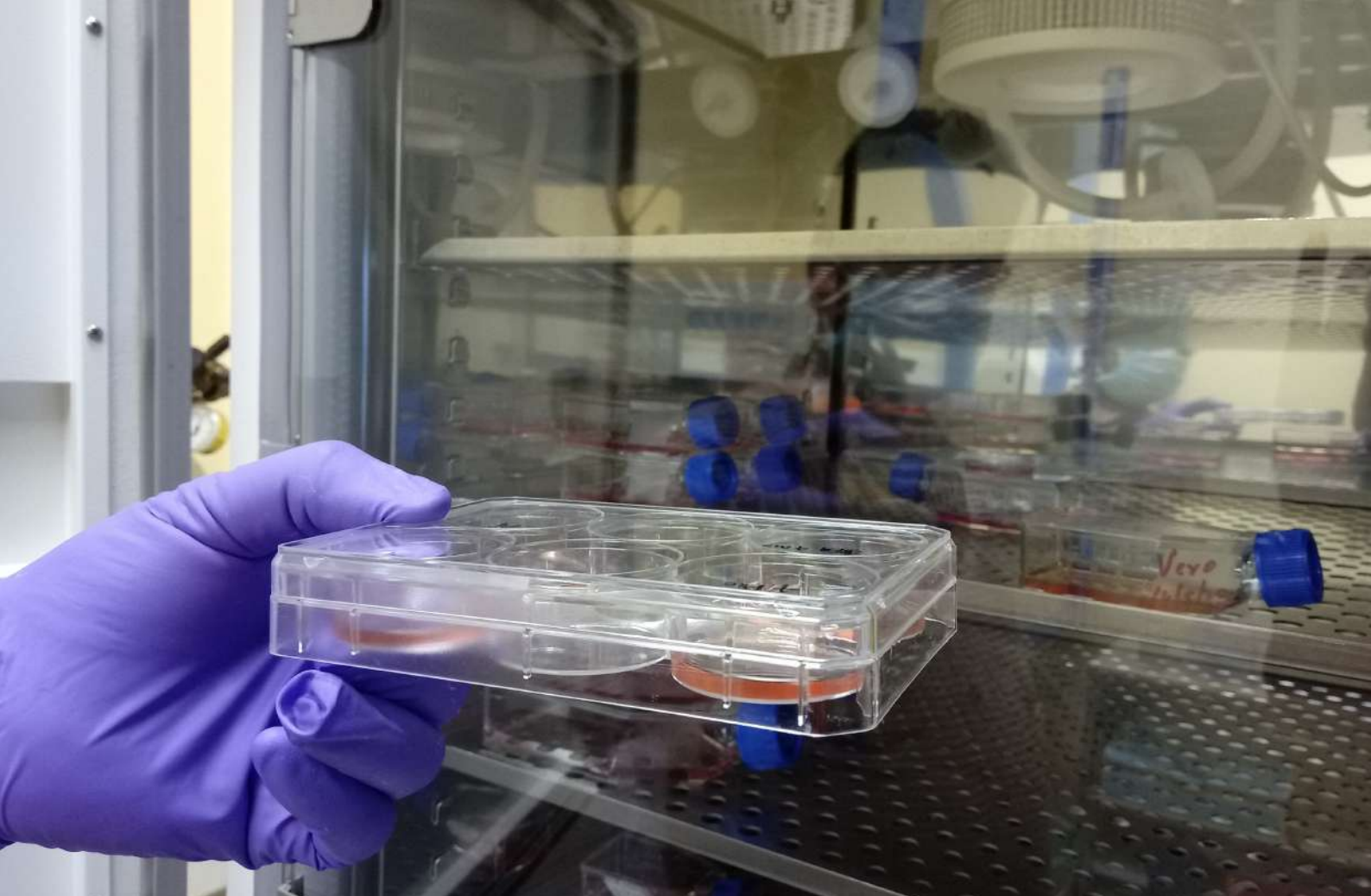


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Cipla and CSIR have been natural partners from the time of the inception of CSIR in 1942. My late Father, Dr K A Hamied was on the governing body of the CSIR from the very beginning. CSIR was founded based on a scheme he had earlier presented to the government.

Over the years, our partnership had led to the development of many interesting drugs starting from steroids in 1960 with RRL, Jammu, many essential drugs with NCL, Pune and CDRI, to affordable HIV drugs in the year 2000 with IICT. Again this year, we have partnered IICT to produce the antiviral drug Favipiravir and market its formulation as well under the brand name Ciplenza to fight COVID-19. This ongoing association will certainly continue in the future and hopefully will result in a greater awareness of self-reliance and self-sufficiency for our country.

Yusuf K Hamied
Chairperson
Cipla



Growing coronavirus (above) in a BSL-3 lab (below) to test efficacy of new drugs and devices and make vaccines



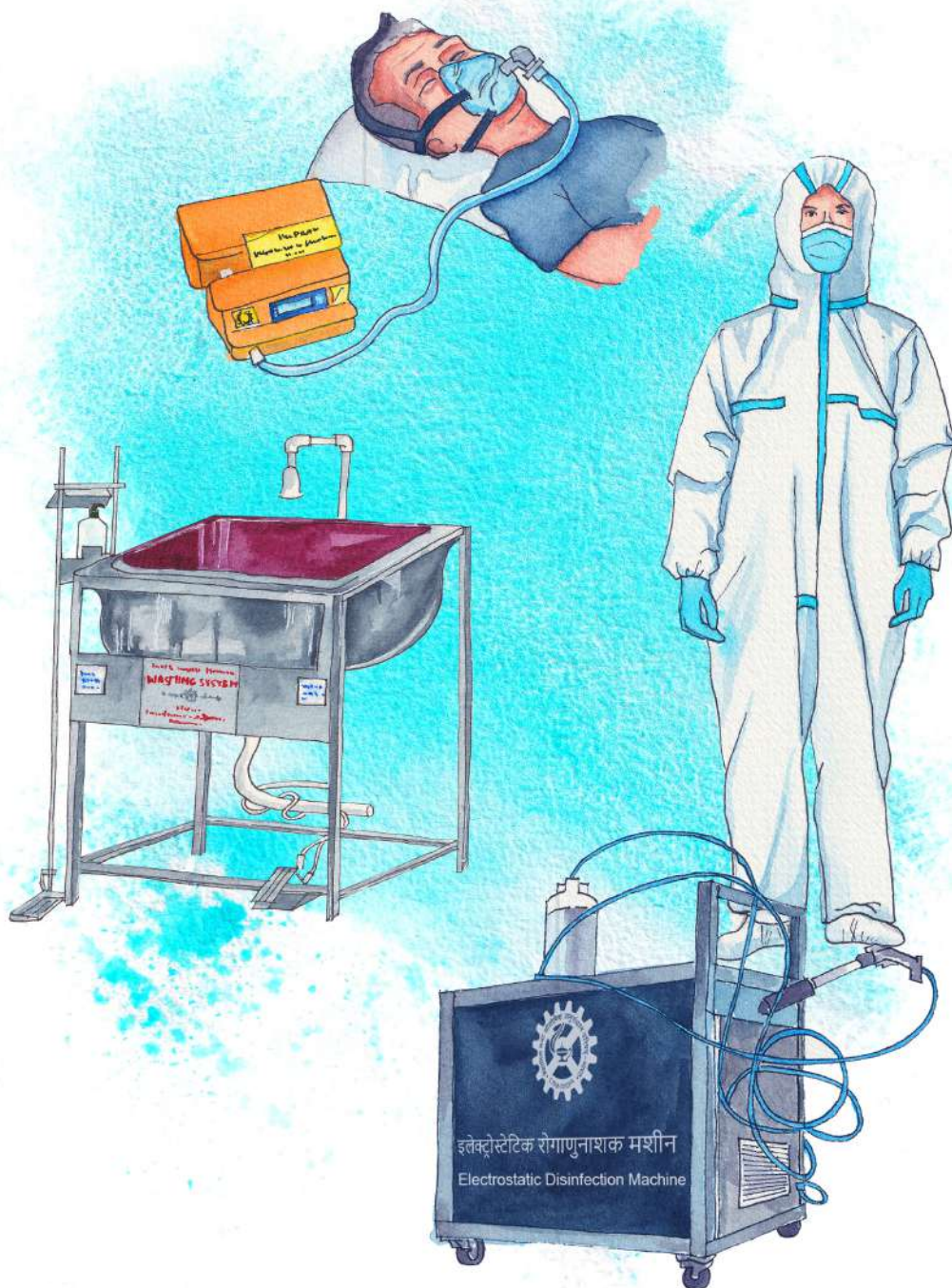


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It was really very early days into the pandemic that CSIR took an initiative to start a randomised control trial for Convalescent Plasma Therapy (CPT) in COVID-19. In early May CSIR-IICB team which took up the program got the nod from CDSCO to start the trial at ID & BG Hospital, Kolkata in collaboration with Government of West Bengal. The trial is currently ongoing. The uniqueness of this trial is the associated immunological studies to correlate with heterogeneity of response to CPT, if any

Dipyaman Ganguly
Principal Scientist
CSIR-IICB

CSIR's technological contributions for healthcare sector through creation of devices and protective gear will be a boon beyond COVID-19.



Of many things that CSIR-NAL does, one of them has been testing of assembly of oxygen masks for indigenously developed helmets. CSIR-NAL has also put in oxygen mask assembly into its own SARAS aircraft.

In the current situation, oxygen masks are in demand for a different reason though. It is common knowledge today that the coronavirus affects the lungs, lowering oxygen levels in the body. The threat posed by the lower oxygen levels can range from mild to critical. Ventilators are required to support such patients.

Earlier this year, as the pandemic spread, hospitals began to run out of ventilators. Realising the deprivation and the resultant effects in patients, the scientists of CSIR-NAL descended on the situation – this time, to help patients breathe on the ground. In just 36 days, the premier institution developed SwasthVayu, a BiPAP non-invasive ventilator for COVID-19 patients.

Not only CSIR-NAL, several other CSIR laboratories developed technologies based on their vast scientific research experiences and deep technological prowess.

The CSIR-NCL, for example, developed an Oxygen Enrichment Unit. Oxygen is required in higher concentration for oxygen therapy in hospitals. It can be as high as 90% for some patients in ICUs and operation theatres and for some others with lung diseases, 27-35 % oxygen is required in breathing air. Normal air has 21% oxygen content.

Recovery of COVID-19 infected patients can be faster if supplemental oxygen is provided in the early stages. It can reduce the number of patients who will need ventilators. Post-ventilator treatment patients can be served with this unit, thus reducing demand for oxygen cylinders. The portability of the Unit makes it convenient for using such units in home care, villages and remote places.

For years, scientists at CSIR-CSIO in Chandigarh have been working on an electrostatic nozzle spraying system. The system was being effectively used for spraying pesticide on crops. The underlying principle of such a system was to have maximum spread and effect with minimal use of pesticide.

CSIR-CSIO immediately innovated on the design of its pesticide electrostatic spraying system, and developed an electrostatic spraying disinfection system against coronavirus. This system produces uniform and fine spray droplets of disinfectants in size range of 10-20 micrometre to kill microorganisms and viruses. Due to the small size of droplets, the surface area of spray droplets increases, thereby enhancing the interaction with harmful organisms such as the coronavirus. The machine uses significantly less disinfection material, thus limiting the presence of the chemicals in the environment.

The technology has been transferred to three companies. Recently, one of the industry partners received a COVID-19 Ignition Grant Award of Rs. 1 cr to scale up the technology in India and US.

As the number of hospital beds fell short, two CSIR laboratories, CSIR-CBRI and the CSIR-SERC with rich experience in handling requirements during natural disasters quickly designed makeshift hospitals and short-term hospital structures.

CSIR-NAL did not draw on its aircraft insights just for the ventilators. When it became apparent that the health professionals required protective coveralls, CSIR-NAL drew on its awareness of the flight suit, the full-body garment, worn while flying military aircraft. The scientists quickly designed a protective cover-all suit that went into production and today, CSIR-NAL's industrial partner manufactures thousands of protective cover-all suits.

COVID-19 may have posed hurdles and imposed limitations but CSIR and its laboratories have taken it as a challenge and have been working

non-stop to contribute their scientific knowledge in service of the nation.

JITENDRA J JADHAV
**VERTICAL HEAD, HOSPITAL ASSISTIVE
DEVICES**





SwasthVayu is the first “Made in India” non-invasive ventilator device developed by the CSIR-NAL in scientific and medical collaboration with Dr Anurag Agrawal, Director CSIR-IGIB. It is timed, and has unique features like Continuous Positive Airway Pressure, Spontaneous/Auto modes with provision to connect oxygen concentrator or enrichment unit externally. The device is ideal to treat patients with respiratory failure in COVID-19 or other situations. These ventilators could also benefit patients suffering from complex sleep-disordered breathing such as Obstructive Sleep Apnea and Central Sleep Apnea.

C M Ananda
Chief Scientist
CSIR-NAL





JUBILEE HOSPITALS

6. We strongly recommend the SwasthVayu –Non Invasive Ventilators can be used in ICU & Non-ICU cases for the treatment of Sleep Apnea, Lung Disease & to treat Respiratory Weakness and is ideal for treating Covid-19 Positive tested Patients with Mild, Moderate & less Severe Symptoms.
7. Also individual Covid-19 Positive Tested Patients with less Symptoms can also use SwasthVayu at their respective homes under the supervision of Doctors, thus avoiding going and admitting into already over crowded Hospitals.

(Handwritten initials)



NIRON HOSPITAL & RESEARCH CENTRE

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Tel.: 2665 3334 / 2665 3335 / 2665 4813 / 2665 4814 • Fax : 91-22-2665 3336
E-mail : niron@rediffmail.com • Website : www.nironhospital.com

Certificate of Performance

08th July 2020

We hereby certify that we are using SwasthVayu BiPaP Machine for about 2 weeks, as supplied to us by Paras Defence & Space Technologies Ltd., Mumbai.

We are using this machine on COVID-19 patients and till date 4 to 5 patients have been treated where SwasthVayu BiPaP Machine is used to treat these patients.

SwasthVayu BiPaP Machine has good performance with high quality materials and mechanics.

(Handwritten signature)
Dr. Rajul Karmakar
Niron Hospital



We were given a task for developing indigenous nasopharyngeal swabs used in sampling of COVID-19 suspects for molecular diagnosis. This was very challenging in several ways like, matching the exact material composition, design specifications, sterilized packaging and cost. These swabs already in use were all imported from multinational companies hence, matching with such product was very crucial. Our team put in all their best and did a wonderful job in terms of analytical standardization of the prototypes made, arriving at exact specifications and SOP to be provided as a know-how package to the industry. Equally important was the enthusiasm, willingness for several iterations and very prompt response of the industry partner to manufacture the product with the right specifications till the product got approved by ICMR. Industry has already delivered 2 lac pieces in the market and built up a capacity for the production of 1-3 lac pieces per day.

C V Rode
Chief Scientist
CSIR-NCL



These safety goggles are designed with flexible frame to provide tighter sealing with the skin on the face, cover the eyes and the surrounding areas and even accommodate for prescription glasses. The goggles comply to ANSI/SEA Z87.1-2010 standard with respect to see-through optical transmittance and can be used in varied environmental conditions without any fogging or fatigue.

Neha Khatri
Senior Scientist
CSIR-CSIO



CSIR-CSIO had taken up the design and development of the safety goggles as a protective eyewear in consultation with various industries and stakeholders to come up with an affordable and innovative precision manufacturing technique for commercial scaling-up. Apart from healthcare professionals, the developed safety goggle is useful for general public in crowded areas as well as in public transports.

Vinod Karar
Chief Scientist
CSIR-CSIO



The company will market the safety goggles developed by CSIR-CSIO in varied customer segments including healthcare workers, frontline police forces and staff of the offices involved in public dealings to ensure safety of the general public.

Ishaan Selhi
New Product Development Engineer
SARK Industries





Production of coverall developed by CSIR-NAL at a company (above), an image of the coverall (below)



“

I would like to convey our sincere thanks to CSIR-NAL for developing an indigenous PPE Kit of good standard and its mass production by transferring the technology to a private partner. The same have been used in our COVID-19 Block by our treating doctors and other healthcare workers, and they have found it sufficiently very good in quality fulfilling all standard protocols.

Gitanjali Batmanabane
Director-AIIMS, Bhubaneswar

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I would like to thank you for providing PPE kits. I got the feedback from the surgeons of Cheluvamba Hospital (OBG) saying that the quality is really good and of immense help. They are being used in the labour rooms and in the operation theatres for suspicious cases of COVID-19 while doing surgical processes and for deliveries.

C. P. Nanjaraj
Director & Dean
Mysore Medical College and Research Institute



Different kinds of sanitization strategies were developed by our labs





Effective disinfection and sanitization of public places is of utmost important so that people can feel safe, be it offices, hospitals, airports, railways, classrooms etc. We worked day and night for almost 2-3 months and came-up with the innovative technology. I have learnt how to deal with crisis situations, keeping energy level high, staying focused and motivated. During this journey from start to final product, I have experienced a great support from our industrial partners. As a proud CSIRian, I can say, we have a great leadership. Nothing is more satisfactory for a scientist than coming-up with meaningful innovations for the benefit of the society and the country at large.

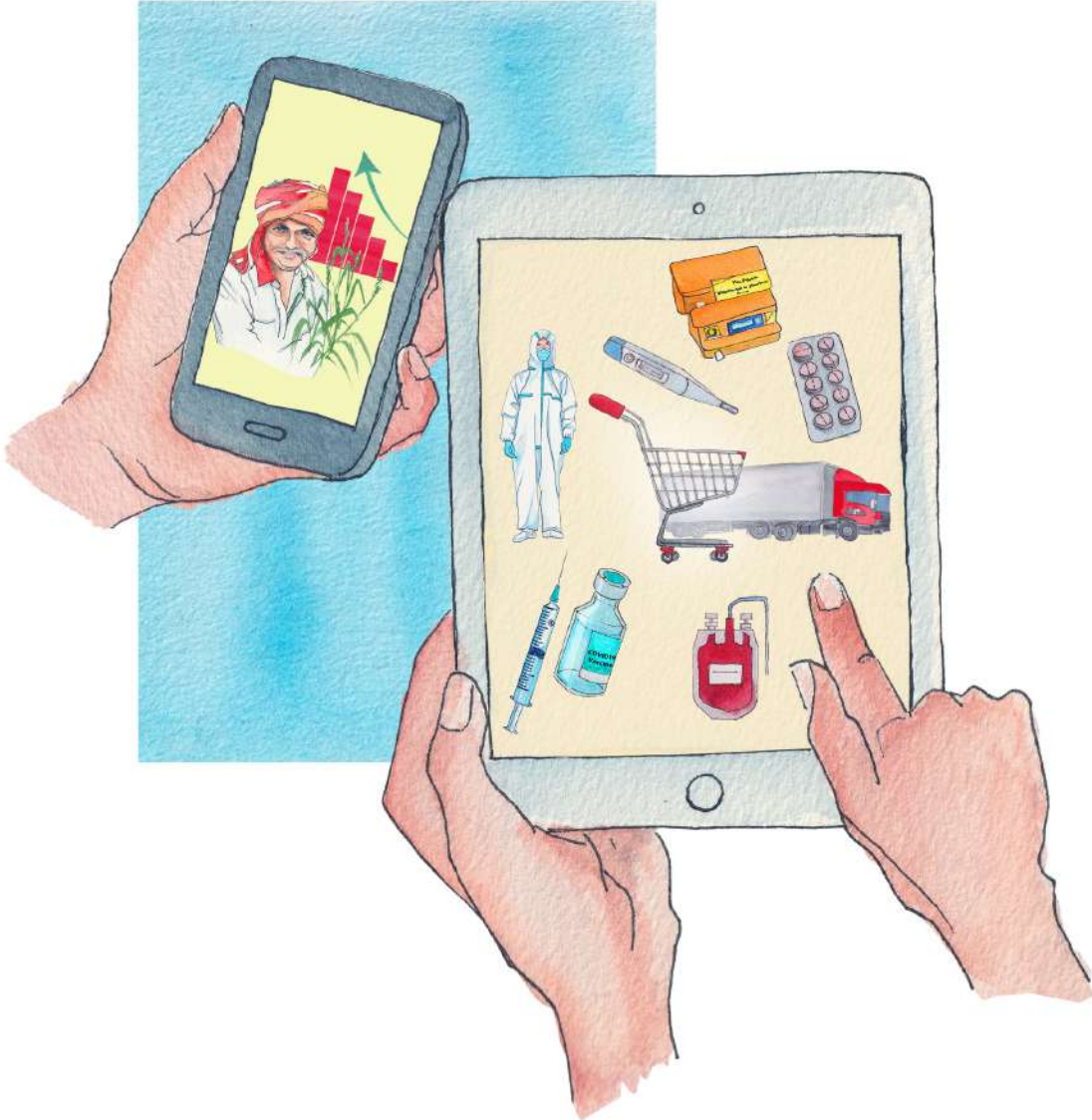
Manoj K Patel
Senior Scientist
CSIR-CSIO



We are highly impressed at the speed of transfer of technology by CSIR-CSIO as it was done in only 3 days that too amidst the lockdown restrictions. Within one month of technology transfer, with continuous support from CSIR-CSIO scientists we have been able to launch the product successfully. Electrostatic disinfection machine can play an important role in infection prevention through surface disinfection applications across hospitals, offices, local bodies, canteens, hotels, airports, trains, buses and restaurants. This technology has made it possible to make cost effective electrostatic sprayers for disinfection and would reduce dependence on imported products being used at present in India. It has been recognized as one of the top COVID-19 innovations by Indo-US science & technology forum – a body of Department of Science & Technology, India and Department of State, USA

Abhijeet Gan
Director & CEO
Rite Water Solutions (I) Pvt Ltd

Innovations mean nothing if they don't reach the users.



Under the veil of the global dark phase due to spread of SARS-CoV2 virus, India was also struck hard. In the gripping situation of the global pandemic, it was earnestly felt by the policymakers and the government, at large, that a series of challenges lie ahead, which will require tremendous efforts by various national agencies in unison. CSIR geared-up for the looming challenges with the available technological and research-driven skills and resources. It has, over the years gathered sufficient experience in providing an unwavering stability to the nation during such upheavals.

Early in India's timeline of the COVID-19 pandemic, it became rather apparent that Supply Chain Management was crucial for ensuring availability of critical items when, as and where needed. Whether for hospital beds, ventilators, lifesaving drugs, sanitizers or Personal Protective Equipment (PPE) like masks and gowns, the twin risks of short supply and opportunistic pricing became all too apparent. Further, quality assurance was a concern; one needed to be sure that products being used by patients and frontline COVID-19 warriors were safe and effective.

Recognizing this need, CSIR introduced a Supply Chain Vertical to complement the efforts in the other four verticals, namely Surveillance, Diagnostics, Drugs and Vaccines, and Hospital Assisted Devices and PPE.

CSIR identified real-time information as a key concern. For instance, because of the extended lockdown, farmers were finding it difficult to transport their perishable produce to agricultural markets ("mandis") and were staring at losses either from post-harvest spoilage or throw away prices being offered by opportunistic traders. At the same time, the number of mouths to feed in villages went up because of widespread reverse migration from cities to villages.

To circumvent these challenges on ground, the Kisan Sabha app was launched by CSIR to enable farmers identify choices of mandis and determine which one was offering them the best net value on that day, i.e. spot price for their produce net of transportation cost to that mandi. The Kisan Sabha web portal and app also allowed farmers to book trucks directly with transporters, thus bringing down middlemen-related costs and shortening the time to market. In barely two months since launch, Kisan Sabha has over 50,000 registered participants and a 4.2 star rating on Google Play. It is available in 12 languages, and has been very well-received across the country. It was a co-ordinated technological effort made by CSIR for empowerment of farmers during the pandemic.

At the same time, when there is a pressing and constant need of healthcare supplies, hospitals and pathology labs experienced shortages of test kits, gowns, nasopharyngeal swabs and other essentials for combating the pandemic and providing timely results to doctors for afflicted patients.

CSIR launched its second portal, www.AarogyaPath.in, to address this issue. It features a unique PIN Code based search, allowing buyers to determine sellers located close to them, especially useful in emergency inventory outages or in local area surges of confirmed cases. Aarogya Path offers products in a wide range of categories, including PPE, Medical Equipment, Diagnostic Kits, Hospital Assisted Devices and even convenience supplies like ready-to-eat nutrition-balanced foods so that hospital pantries can operate with minimal staff and reduced operational effort. It also provides access to services such as temporary nurses, physiotherapists and physicians willing to make house calls. These are particularly important as hospital access for non-COVID diseases are inconvenient and often not advised during the pandemic, especially for chronic and elderly patients.

As a number of new products are being developed and launched by CSIR, it was also essential that awareness of these products is built at regional levels. This initiative – of Regional Inventory Management and a Regional Product Showcase to display the CSIR-developed product range either physically or virtually – spans 15 CSIR laboratories across India from Jammu to Trivandrum. The new product launch process itself is also facilitated by the Supply Chain Vertical; bills of materials for all COVID-19 relevant products are critically reviewed to spot risks arising out of either single-source or imported materials. A case in point is Hydroxychloroquine (HCQ), a first-choice drug for mild-symptom cases of COVID-19. Supply chain analysis of the HCQ Active Pharmaceutical Ingredient (API) showed that 8 out of its 10 key intermediates were imported. An alternate manufacturing process using largely local raw materials was then developed on a war footing by CSIR-IICT, Hyderabad, and made available to the Indian industry.

Over and beyond the pandemic, the Supply

Chain Vertical also recognized another important item with a supply-demand mismatch – between employment and entrepreneurial opportunities in rural India with the traditional skillsets available there. To tap this and strengthen the rural economy in a sustainable manner through targeted skill development and entrepreneurship enhancement programmes, CSIR has signed Memoranda of Understanding (MOUs) with Unnat Bharat Abhiyan, championed by IIT Delhi and Vijnana Bharati, with Himalayan Environmental Studies & Conservation Organisation (HESCO) and with Sewa International. In a short span of four months, challenges and issues arising due to COVID-19 were identified by SCM team and were addressed with the available human and technological resources. However, as we march ahead towards post-COVID-19 wave, CSIR continues to strive to address both short and long term challenges and deliver swiftly by funneling its research and development backed resources to the nation.

ANJAN RAY
VERTICAL HEAD, SUPPLY CHAIN



विज्ञान और प्रौद्योगिकी मंत्रालय
MINISTRY OF SCIENCE
AND TECHNOLOGY
GOVERNMENT OF INDIA



my
GOV
मेरी सरकार
blog

AAROGYAPATH

An Information Portal providing the path towards **Aarogya (Healthy Life)**



“

It was a singularly wonderful experience to interact with scientists from different domains and learn from them while they tackled an important issue head on. There were times when even the problem was beyond my comprehension, but the discussions helped me learn some issues that require supply chain management.

Kaushik Chakraborty
Senior Staff Scientist
CSIR-IGIB

“

Great support system and intellect from CSIR kept raising standards by targetting Healthcare Supply Chain gaps. It streamlined thought process, system, information for Pandemic situation and created bridge for quality healthcare product manufacturers, suppliers and customers. Aarogyapath became reflection of strong team beliefs and efforts.

Farhat Azad
Aarogyapath Team
CSIR-CRRI



“

Ensuring supply chain continuity is most vital and imperative for the continuity of any research and development during the COVID-19 era. Timely issue tracking and adapting to the lockdown situation became one of the highest priority areas that posed considerable challenges for the CSIR central supply chain management team. Conducting and attending innumerable brainstorming sessions, with innovators and management to tackle these challenges, helped us to nail down the issues and overcome them promptly.

Rajesh Barnwal
Principal Scientist
CSIR-CMERI

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Supply chain management is the key process for the success in the pandemic to cater to the wide variety of unexpected demands. The success in a war or in a pandemic situation mainly depends on efficient supply chains, as does the economy of a nation under unprecedented situations.

P N Gupta
Principal Scientist
CSIR-IIIM

The channel on Pre-emptive Identification of Supply Chain Issues in New Launches of CSIR Products and Services for COVID-19 Management mainly focuses on identifying issues and challenges encountered in the launch of products and services. The whole exercise was a learning process for the technology developers as well as the supply chain team to identify, analyse and address the issues encountered in order to ensure a smooth delivery of products and services to the appropriate market at the appropriate time. This whole effort, though started for the current COVID-19 pandemic, has a larger role to play in the entire product development process of CSIR. It certainly will bring about a paradigm change in the way product development is considered in CSIR.

Rashmi Arya
Senior Scientist
CSIR-URDIP

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To add value in farmer's lives, who work in acres not counting hours, was not a blind faith but a firm conviction!!! Kisan Sabha app has spread pan-India, and will add positive change in farmer's lives. This is not hoping to be true, but we are making it true!!

Farhat Azad
Aarogyapath Team
CSIR-CRRI

“

Being part of the Supply Chain Group has been an enriching experience, I've learnt things that I never expected I ever would. The group is a perfect example of how, when people with differing areas of expertise work towards a common cause, they can truly make a difference.

Raghunand Tirumalai
Principal Scientist
CSIR-CCMB





Enhancing Farmers Income with Kisan Sabha Portal

Features

- 

Kisan Sabha has 6 major modules, one each dedicated for farmers, mandi dealers, transporters, mandi board members, service providers & consumers
- 

It connects the farmers directly to transporters, service providers, mandi dealers, customers like big retail outlets, online stores, etc.
- 

Farmers to have the option for the best rated mandi out of 4 nearby mandis
- 

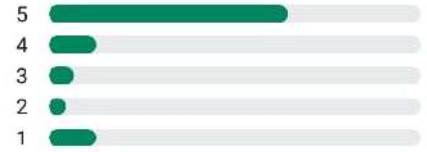
Options to choose cheapest transport facility with a freight calculator

Ratings and reviews ⓘ



4.2

★★★★★
163



A Ashwani Basati

★★★★★ 04/07/20

Great app with lots of functionality. Easy to use interface. As a farmer it helps me a lot as I can contact with mandi dealers and shops directly.

Was this review helpful?

Yes

No

m mohit bansal

★★★★★ 02/05/20

Oh my my! This app is making me really witness the positive impact IT sector is having on our's. It has been of a great help to me as a farm manager in managing my sales and purchases. Plus most importantly there's absolutely no rocket science involved in using this one. So damn easy and convenient. Highly recommended.



A thought became an idea, and an execution of idea became a team. Supply Chain Management (SCM) team has focused on maximizing value to the end users during pandemic by building a chain of suppliers. SCM teaches respecting simple labour to a general manager, and also how a bolt or few litres of solvent is crucial for supporting country. I appreciate wholeheartedly to all the team members led by Dr. Anjan Ray, whose untiring efforts made this campaign worthy. There were several points where his excellent problem-solving skills and creativity allowed us to swiftly resolve issues that might have easily escalated into roadblocks.

Dwight D Eisenhower said it right, "You will not find it difficult to prove that battles, campaigns and even wars have been won or lost primarily because of logistics/Supply chain.

Hemant J Purohit
Chief Scientist, Head - Environmental Biotechnology and Genomics Division
CSIR-NEERI



Success Stories: Annadatas becoming Self Reliant with Kisan Sabha Portal



Over 11,000 farmers,
29,000 transporters, 1,100
Mandi Dealers, 5,000 Service
Providers & over 3700
consumers users



20 women Self Help Groups
(SHG's) being created using
Kisan Sabha



Currently operational in
6 districts of Odisha covering
13 Blocks with outreach to
200 Panchayats



Over 1 lakh app downloads in
just 3 months & available in 12
regional languages



4.2 rating on Google Play Store
& hundreds of positive reviews
on the Kisan Sabha Facebook

7:54 PM

4G



Kisan Sabha (CSIR) 4.2 ★
Ratings and reviews



Souvik Bardhan



★★★★★ 02/05/20

It seems like a very useful app. I checked for mandis and I think it will definitely help me to raise my profit margin as requirement of any aadatis(middlemen)is eliminated. The transportation facility is also looking efficient and the cost is pretty much genuine. Definitely worth a shot . Glad that someone is taking steps towards the betterment of us farmers.

Was this review helpful?

Yes

No



Ribhu Maitra



★★★★★ 02/05/20

A big thumbs up to the guys who developed this, this app actually helped me out to get real time mandi rates and got me out of some bargaining issues. Even during this pandemic, they have been providing customer support and the rates too.

While research and development of novel technologies take time, there are always efforts that can be done with the scientific expertise and capabilities we have.



As the country witnessed the onset and spread of the SARS-CoV-2 pandemic followed by the country wide lockdown in late March and April, there was severe shortage of the 'essential commodities' such as sanitizers and masks. CSIR labs quickly rose to the occasion. The biological and chemical laboratories of CSIR dipped into their expertise and portfolio of technologies to immediately come up with safe, alcohol-based effective hand sanitizers and disinfectants based on WHO guidelines.

More than 10 CSIR laboratories manufactured and distributed more than 50,000 litres of sanitizers and disinfectants among more than 100,000 personnel belonging to local administration, police force, municipal corporations, electricity supply undertakings, medical colleges, hospitals, panchayats, and banks. The laboratories also managed to rope in industries for large-scale production of sanitizers.

Many CSIR labs also distributed masks to the workers and families around their campuses. CSIR-CMERI had produced three layered masks and distributed more than 2 lacs of them. Further, Cipla Foundation and CSIR-IICT partnered for mass production of the CSIR-IICT designed face masks under the project name "SAANS". This enabled free distribution of 1 lac face masks to the rural populace particularly to the school children and the elderly in 5-6 mandals of rural parts of Telangana will be carried out.

Another humanitarian crisis loomed with the migrants facing shortage of food during the months of April and May. Yet again CSIR labs chipped in with ready to eat food. CSIR labs such as CSIR-CFTRI, Mysore, CSIR-IHBT, Palampur, CSIR-IMMT, Bhubaneswar, CSIR-CIMFR, Dhanbad and CSIR-IIP, Dehradun and others have provided ready to eat food to migrant labourers, patients, health workers, police and many others during the COVID-19 outbreak.

CSIR-CFTRI stepped in to provide 10 tonnes of high-protein biscuits, 1 tonne of spirulina chikki, 10 tonnes of cardamom-flavoured water, and 5 tonnes of nutrifruit bars to more than 56,000 migrant labourers, patients, doctors and police in two metropolises.

CSIR-CFTRI joined hands with the Income Tax Departments of Karnataka and Goa in providing relief food to the migrant labourers affected by the COVID-19 lockdown.

CSIR-CFTRI also supplied 500 kg of high protein biscuits and 500 kg of high-protein rusks to the AIIMS-New Delhi for recuperating COVID-19 patients, on special request from the AIIMS. The biscuits are 60-80% richer in protein than usual biscuits.

While in the North, on being informed by a Panchayat representative that several migrant labour families who were stuck due to the lockdown were struggling to find food, CSIR-IHBT, another institute well-known for its food processing technologies, put its act together and supplied 5000 boxes containing 60 tons of Dal Chawal Aloo Mix, 2.16 tons of ready-to-eat local Kangra cuisine, 1500 spirulina peanut bars, 1000 multigrain energy bars, and 1500 multigrain protein powder not only for the migrant labour but also for frontline workers like doctors, paramedical staff, health workers and policemen.

CSIR-IMMT also delivered 30,000 of ready-to-eat khichidi along with hand sanitizer, and soap provided by CSIR-IHBT to the Commissionerate Police, Bhubaneswar. And the staff of CSIR-CIMFR posted at the Donimalai Iron Ore Mine in Karnataka also put in their bit by distributing food packets containing essential rations for the needy.



Distribution of nutritious food, masks and sanitizers - simple but important things that became scarce during the crisis



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CSIR-CFTRI have been an awesome partner in this endeavour. Without any bureaucratic hindrances we could immediately distribute protein-enriched biscuits and spirulina chikkis among the migrant labour. It was heart-warming to see children relishing the products. I think this is also a fine example of taking science to the people.

Zakir Thomas
Principal Income Tax Commissioner, Bengaluru



Cipla Foundation



@CiplaFoundation

Watch us LIVE at 10:30am today as we start our journey with CSIR-IICT (Indian Institute of Chemical Technology) [@csiriict](#). Partnering to support development & production of a first-of-its-kind multi-layered, quality certified, low-cost face mask 'SAANS' [facebook.com/Ciplafoundatio...](#)



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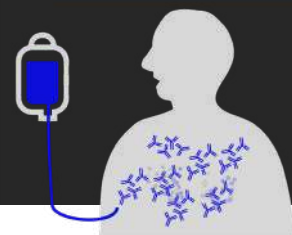
Communicating the details of virus and the disease to public in various Indian languages



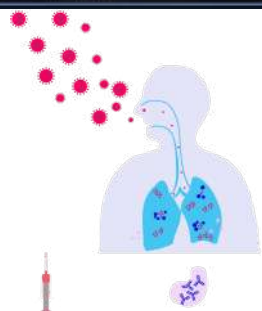
Interventions for mitigating COVID-19



Plasma Therapy and Vaccines (In Bengali)



COVID-19 Testing and Treatment Initiatives by CSIR (in Telugu)



COVID Fight: A peek into the global scenario (In Marathi)



Unravelling the Coronavirus (in Hindi)



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I thank you for arranging the Tamil webinar on contribution of CSIR in mitigating COVID - 19 to spread the innovations by CSIR-CECRI, CLRI and SERC among the public. The cost -effective and viable products, to protect from the coronavirus, explained in Tamil by Dr. Kalaiselvi Director CECEI, Dr. Sriram Director and Dr. Ganamani Chief Scientist CLRI and Dr. Palani Chief Scientist SERC, were made easy to understand and to adopt.

Duraiswamy Lakshmanan
Former Principal Scientist
CSIR-CLRI

Way Forward

"The science of today
is the technology of tomorrow."

Edward Teller

Over the past six months, CSIR has been able to execute a strategy that has aimed at developing solutions, technologies and products that can mitigate the COVID-19 pandemic and its associated challenges. As described by the various contributors, CSIR has been successful in developing a wide variety of solutions and interventions in a short period of time.

It has been able to deliver so due to

1. The strong foundation in R&D that has been built over several decades,
2. The partnership with Industry in translation and commercialization,
3. Cooperation and synergy within CSIR and working as 'ONE CSIR',
4. Engagement and consultation with various stakeholders from Government, Industry, NGOs, MSMEs, etc, and
5. Skilled and talented human resources.

The investments in infrastructure and nurturing of human resources done in infectious diseases programs at several CSIR labs such as CSIR-CCMB and CSIR-IMTECH, robust genomics programs at CSIR-IGIB and CSIR-CCMB have contributed to the molecular and digital surveillance and also development of diagnostics and augmentation of COVID-19 testing. On the COVID-19 testing front, 13 CSIR labs across different disciplines and geographies contributed to the efforts due to their tremendous capability and capacity apart from the commitment.

In the drugs and therapeutics vertical, the strong chemistry expertise and experience in pharmaceuticals of several CSIR labs such as CSIR-IICT, CSIR-CDRI, CSIR-IICB, CSIR-NIIST, CSIR-IIIM and others contributed immensely to the development of repurposed drugs such as Favipiravir, Remdesivir, Umifenovir and others for COVID-19. The strength of CSIR-IIIM in natural products and AYUSH drugs was instrumental in harnessing traditional medicine for COVID-19 by taking up clinical trials.

The engineering skills of labs such as CSIR-NAL, CSIR-CSIO, CSIR-CMERI, CSIR-IMMT among others helped in developing quick devices and PPEs such as ventilators, disinfectants, coveralls,

and 3-D shields to meet the critical unmet needs early during the pandemic.

The success stories such as FELUDA diagnostic test, developing NGS based diagnostics or the ability to sequence and analyze large number of viral genomes in a short time show us that the way forward is to invest in strong R&D, build capacity and encourage innovation among scientists - young and old. Without investment and strengthening the R&D base including fundamental science, new innovations are inconceivable. In absence of innovation, the ability to face the challenges of a pandemic or other major calamities is curtailed leading to disastrous consequences of unconceivable proportions.

The other learning of the current pandemic that is worth noting is also the need for the strong partnership with industry in the translation and dissemination of products and technologies. In the absence of this collaboration, much of the R&D would remain as 'potential technologies' without the last mile delivery. It is imperative that the association with industry is sustained beyond COVID-19, which will help in translation and bridging the gap from the lab to the market.

One of the major impacts of the unforeseen COVID-19 pandemic was the realization of the disruption of supply chains and dependence on imports for many critical items including electronics, sensors, APIs and formulations which was a wakeup call for the entire S&T community and industry at large. The pandemic has revealed the need for 'self-sufficiency' or 'Atmanirbhar Bharat' if the country has to navigate the current and the future crises.

However, attaining self-sufficiency is not an end game. In the constantly evolving world, it is critical to have the technological and innovation capability backed by sustained investment in S&T, promotion of excellence and encouraging innovation. It is only through the application of today's learnings we can build future preparedness and today's adversity is what will help us prepare for future pandemics.

"Atmanirbhar Bharat is not about being self-contained or being closed to the world, it is about being self-sustaining and self-generating. We will pursue policies that promote efficiency, equity and resilience."

Shri Narendra Modi, Hon'ble Prime Minister
at India Global Week 2020

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