

Regional Workshop on New paradigms of innovation and technology to address the challenges of COVID-19 pandemic

APCTT, United Nations Economic and Social Commission for Asia & the Pacific and
Ministry of Innovative Development, Republic of Uzbekistan

3 November 2020

Role of academic institutions in the development of innovative technologies to respond to COVID-19

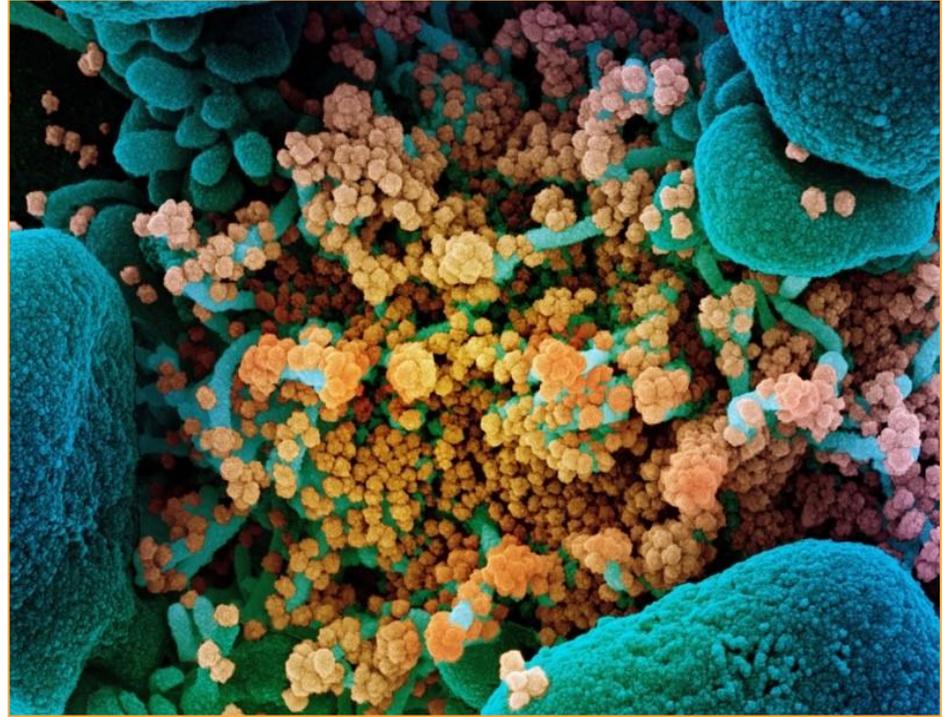
Rakesh Mishra



The COVID-19 pandemic has become the worst public-health crisis in a century.

In just 10 months:
45 million cases
1.18 million deaths
and counting...

It also catalysed a research revolution to understand the virus: **SARS-CoV-2**



A colorized scanning electron micrograph of a cell (green) heavily infected with particles (orange) from the virus that causes COVID-19, isolated from a patient sample. Credit: NIAID/NIH/SPL

Why should the academic institutions respond?

What can be done?

The assets:

Strengths of basics of science

Young sharp minds

Not just technical- questioning and innovating

Trained to deal with the uncertain/unexpected

Their enthusiasm

When a new infection arrives: what do we need to do immediately?

Detection and Diagnosis:

accessible, feasible, high throughput,... methods

Controlling the spread:

technical, behavioral, governmental,... interventions

Associated issues:

new normals, information/policy,... ideas

**Considering the scientific and technical context, academic organizations
must take initiative, innovate and contribute.**

Communicating the unknown

Keeping politicians, policymakers, academic peers, media & general public informed

In times of uncertainty, it becomes extremely important for people to have credible sources of information.

Scientists hold an extremely important role during the crisis, and hence it has been more important than ever to be accessible.

Also new information is coming out every few days. So, it is important to have a continued discussion with media, policymakers and public to give them the best suggestions for that time.

Multiple roles of CSIR-CCMB in fight against COVID-19

Our students' contributions are many fold

Testing center

Training center

Validation center

National repository (virus and patient samples)

Culturing the virus in lab to enable:

Testing/screening of drugs

Testing/validation of devices

Developing diagnostic methods, protocols, SOPs

Genome dynamics of the virus

Understanding the biology of the virus

Training for testing

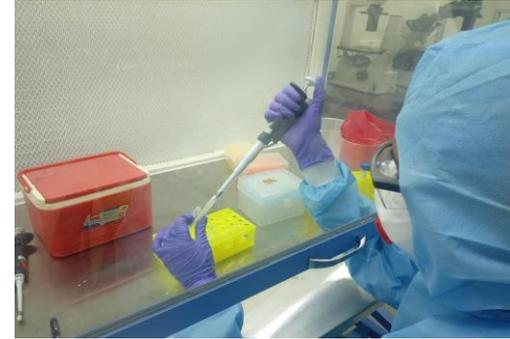


Training staff and students from research/academic institutions

Training doctors from government/private hospitals

SOPs and training videos to establish new testing centres

Testing for COVID-19

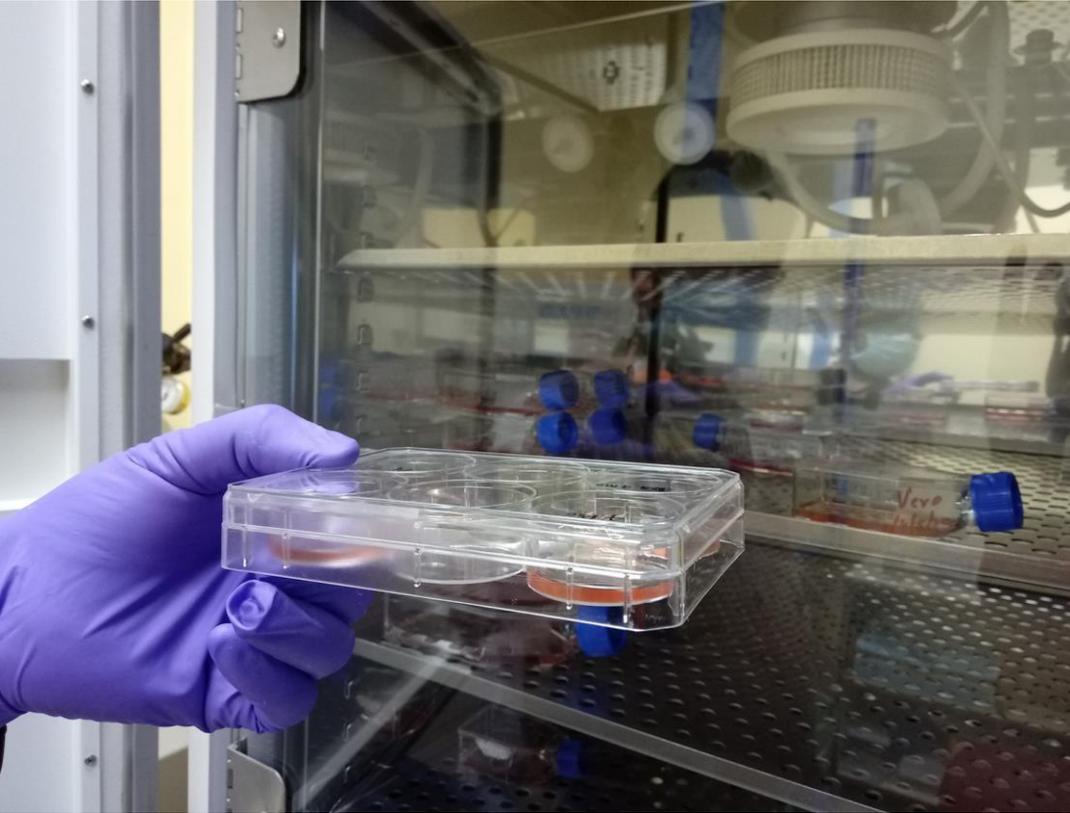


One of the early labs to get involved and continuing...

Improvements:

Reduce VTM volume

Pooling of samples from low prevalence areas



Development of various therapeutics on cell-culture based platforms

Growing coronavirus

Understanding the biology

- Testing potential drugs, etc.
(**>25 drugs, etc., tested**)
(**one nutraceutical in the market**)
- Evaluate sanitization strategies
(**Several devices, etc., validated**)
- Development of antisera
Vaccines
Neutralizing antibodies
(**Entering human trial next month**)

Developing newer ways to test

The Dry Swab method

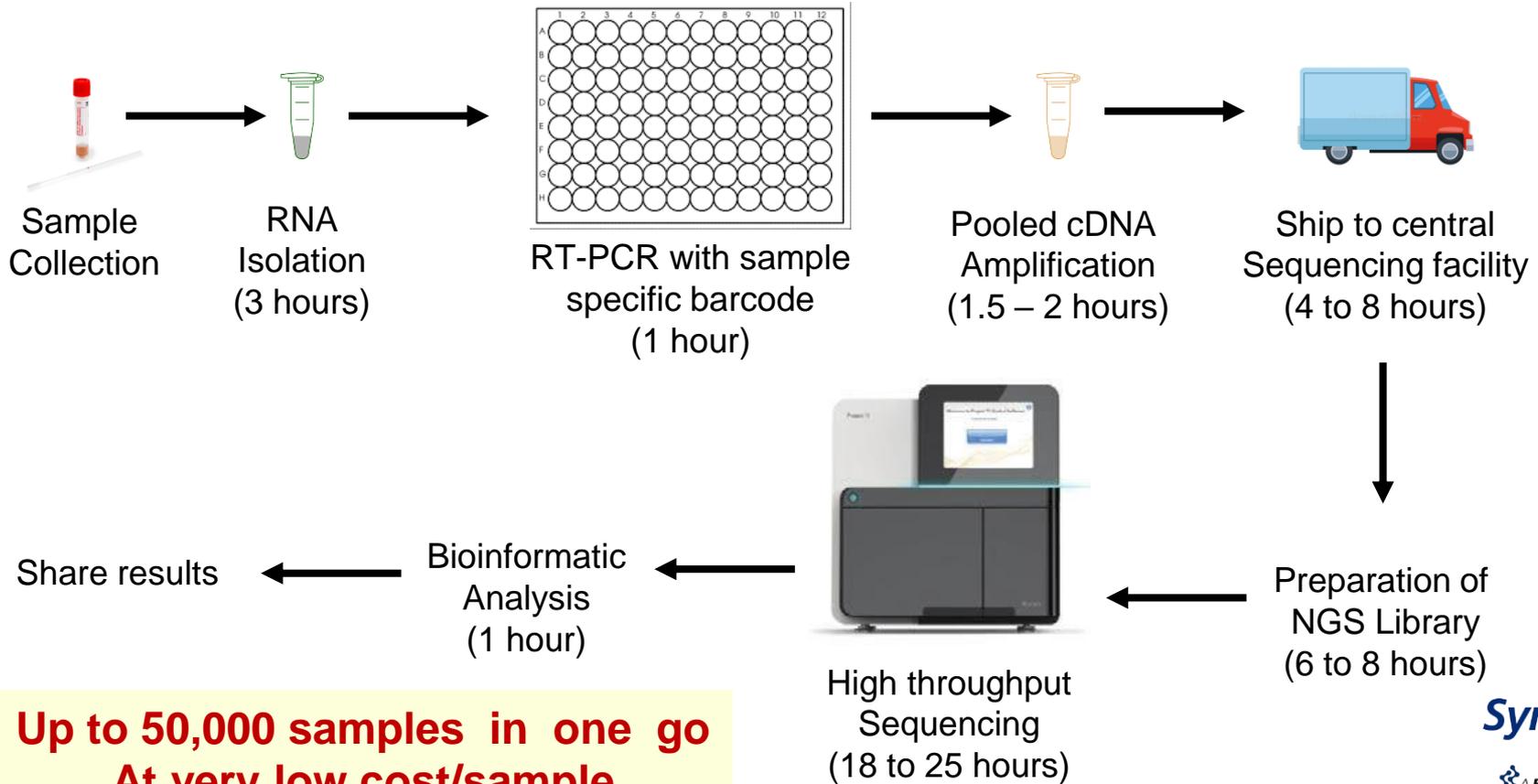
Method variants	Distinguishing features			Sensitivity	Comment
	Swab in VTM	Dry swab & TE(Pro-K)*	RNA extraction		
Current gold standard	Swab in VTM	Dry swab & TE(Pro-K)*	RNA extraction	70-80%	Accepted by ICMR
Dry Swab	Swab in VTM	Dry swab & TE(Pro-K)*	RNA extraction	70-80%	Safer, 50% cheaper, 4-5x higher throughput. Proposed alternative of current method

This method omits the RNA extraction step and is recommended with ICMR approved RTqPCR kit

- RNA Extraction Free and Direct RT-PCR
- No new equipment or reagents needed
- With the current manpower and funds up to 3-4 times more testing can be done with this method
- Safer to handle as no liquid during transportation
- Half the cost and half the time



NGS based COVID19 Diagnostics - Strategy



**Up to 50,000 samples in one go
At very low cost/sample**

Genome dynamics of the virus

Monitoring the
spread of the virus
NGS-based
approaches



GEAR-19

Genome Evolution Analysis Resource
for COVID-19
BIC, CSIR-CCMB

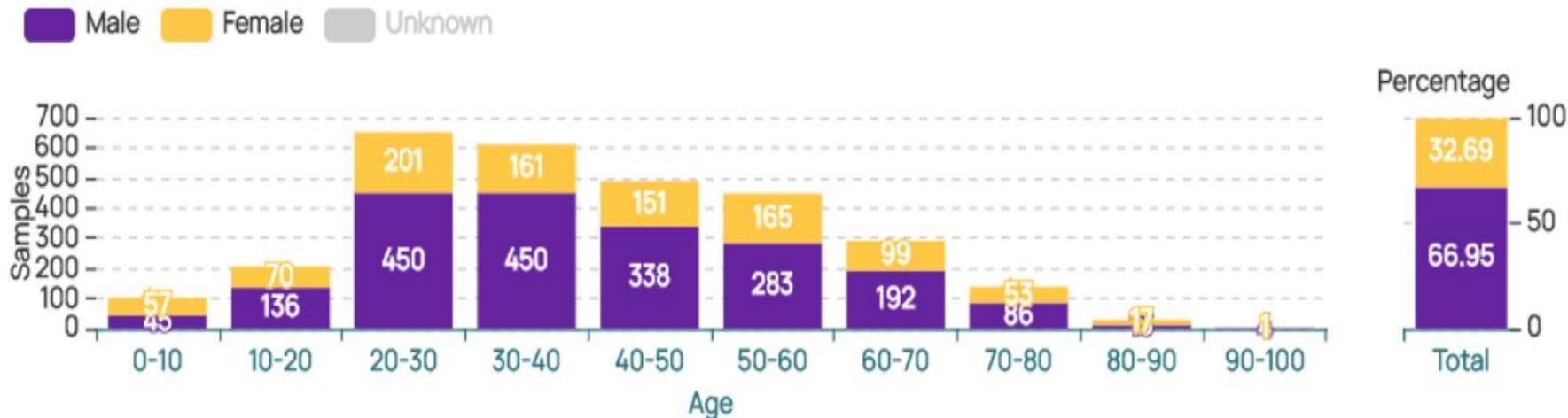
Genomes Sequenced

3154

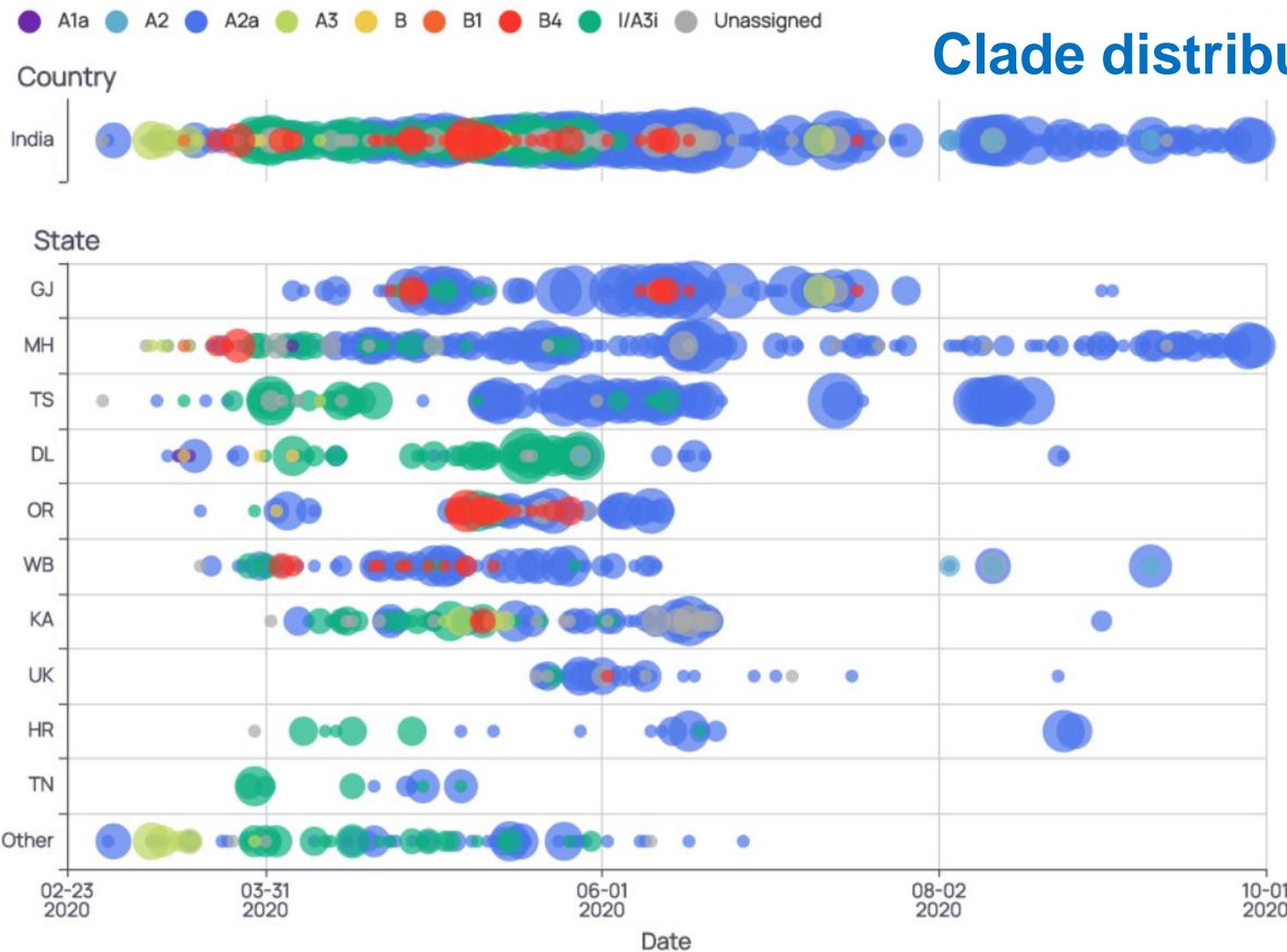


Variants Catalogued

4493



Clade distribution timeline



A3i clade was the prevalent March/April

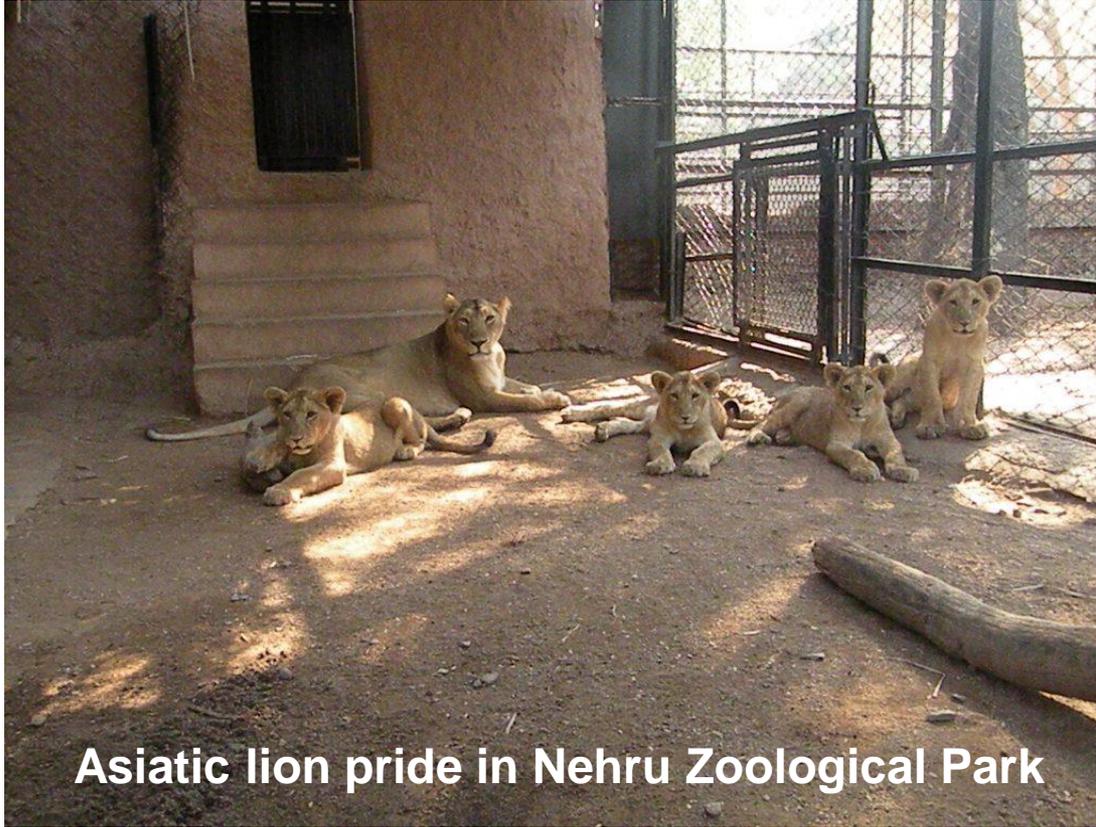
A2a is the current prevalent clade

A3i is now non-existent

Clade	Prevalence
A2a	74.51%
I/A3i	16.07%
B4	2.73%
Others	1.81%
?	4.88%

Novelties... innovations...

SARS CoV-2 testing in zoo



Asiatic lion pride in Nehru Zoological Park

Hyderabad Zoo is the coordinating conservation breeding of Asiatic lions in the country

**5.5 years old lioness
Sickness/symptoms
Suspected of COVID-19
Zoo keeper diagnosed +ve**

**CZA approached CCMB
sample collection
testing
resolved**

COVID-19 Surveillance: Air & Water

Air sampling - viral load estimation

Air sampler gelatin filters:

ICUs, nurse rooms,
Covid ward
hospital corridor

~4 feet from patients



Traces of virus were detected in the air samples from ICU and Covid ward

Effluent based epidemiological study



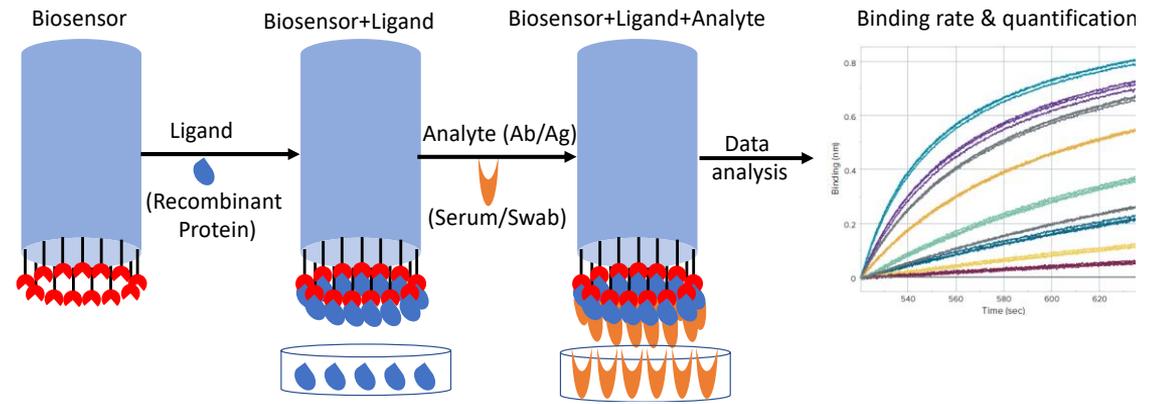
CCMB & IICT collaboration

Novelties... innovations...

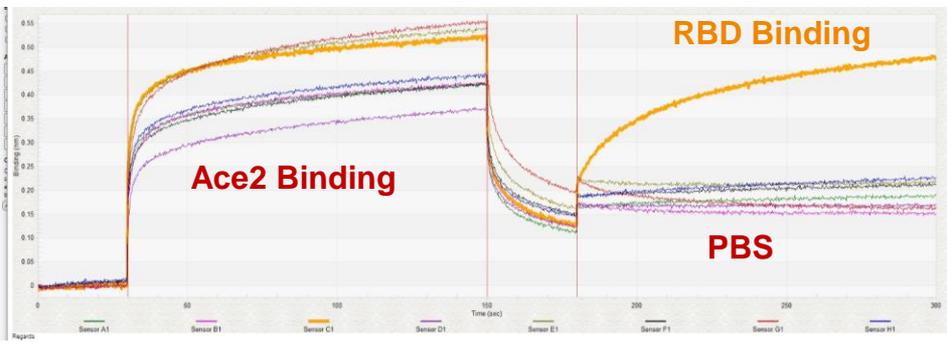
Identification and quantification of total Ab or antigen specific to SARS-CoV-2



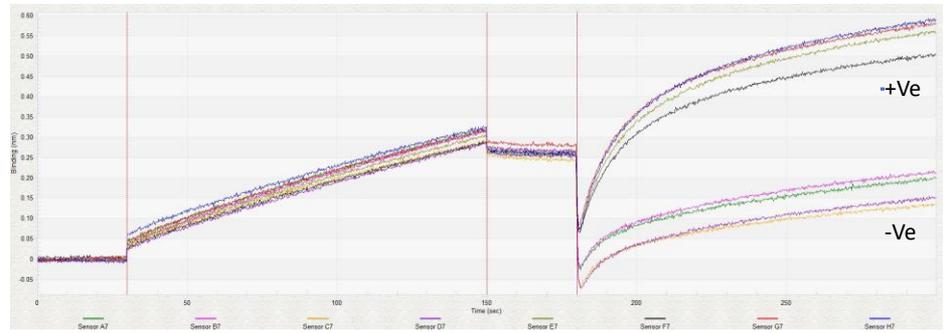
Developed on a FortBio Octet Platform [Bio-Layer Interferometry]



COVID Antigen Binding



Antibody detection in blood



What do we need for future readiness?

Disease Surveillance: **Vectors (flies, mosquitos, ...)**
 Parasites (virus, protozoa, bacteria,...)
 Surveillance through air & water

Zoonotic Disease Surveillance:
 Increasing 'wildlife-people' contacts
 Cattle-people contact
 Consumption of wildlife substances

Quick diagnostics: **Preparedness**
 Quick adaptation
 Indigenization

Academic organizations must accept the challenge and take initiatives.

Need of the hour

Educate to fight fear mongering, superstitions and stigma

can we do something here?

Massive testing, tracking, isolating and 'the social vaccine'

can we do something here?

Goal oriented R&D and uphold public trust in science

can we do something here?

Consider no drug, no vaccine, no magic...

The available Social Vaccine:



Mask

(simple cloth masks, worn properly)

Social/physical distancing

(avoid confined environment)

Frequent hand wash with soap

(disinfectant is second best)

