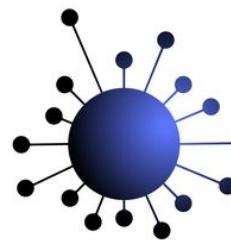




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Just One Giant Lab
learning & solving together



OPEN COVID19
initiative

WE CAN ALL CONTRIBUTE



Why Opening Research and Innovation Especially in a big challenging times!

THOMAS LANDRAIN

@Tholand_



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Open diagnostics

Open bioproduction

Open personal data

One Hour Covid Test

- Ellen Jorgensen, Chris Monaco & Sarah Ware

CoronaDetective

- Guy Aidelberg & Rachel Aronoff

Corona Hunter

- Aravindh Panch

ViralALERT

- Ali Bektaş

Open Enzyme Production and Purification for COVID19 Diagnostics

- Scott Pownall
- Kathrin Hadasch

Quantified Flu: Using wearables to predict infections

- Bastian Greshake Tzovaras

FREQUENT. FAST. CHEAP. EASY.

PHASE Solution Development



4 JOGL teams
made it to the
semifinal round!

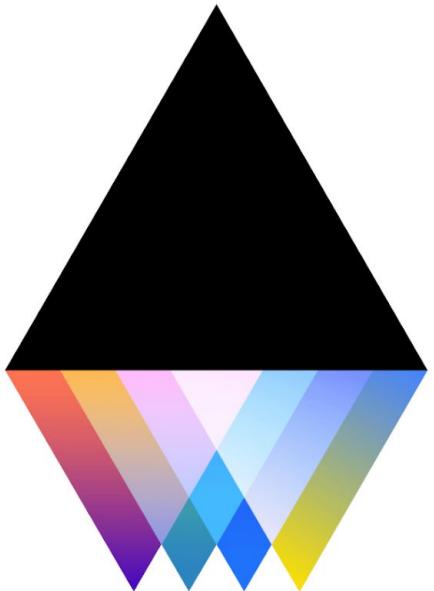
[Get Involved](#)



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How has JOGL facilitated our success?

- Web-based, open source
- Anyone can create a project, ask for resources, recruit members
- Facilitates collaboration across disciplines, geography, backgrounds
- JOGL MicroGrants enable bootstrapping

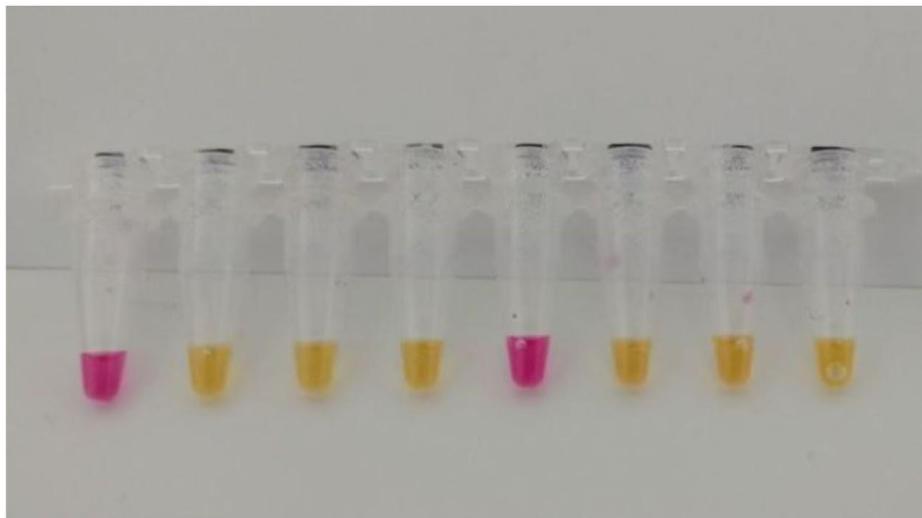


Just One Giant Lab

Just One Giant Lab (JOGL) is the first **research and innovation laboratory** operating as a distributed, open and massive mobilisation **platform** for collaborative task solving. JOGL **helps humanity to sync** onto fixing our most urgent and important problems using **Open Science, Responsible Innovation** and **Continuous Learning**. JOGL partners with academic labs, companies, startups, foundations, NGOs and public services to create **participatory research programs** for understanding and solving Health, Environmental, Social and Humanitarian issues.

Come **challenge yourself** by fostering humanity's open knowledge and developing solutions to the **Sustainable Development Goals** (SDG's) defined by the United Nations!

ONE-HOUR COVID TEST USING LAMP



#1HourCovidTest

Can we create a Covid-19 diagnostic that is based on colorimetric readout isothermal amplification and can go from sample collection to result in one hour using just a heat source and a pipettor?

Created on: March 26, 2020

by [Ellen Jorgensen](#)

Participating to challenge(s): [Covid19 Diagnostic and Detection](#)

SDG's



Skills

Molecular biology

Open science

Diybio





8

 Share

News & Updates

About

Needs

Documents



CHALLENGE {COVID19 DIAGNOSTIC AND DETECTION}



Program: OpenCovid19 Initiative

Research and develop open-source and low-cost solutions to detect Covid-

19

[Join challenge](#)



Accepting projects

27 Projects

43 Needs

566 Participants

- [Home](#)
- [About](#)
- [News & Updates](#)
- [Projects](#)
- [Needs](#)

LATEST PROJECTS



CORONA HUNTER



A project to develop an open-source

[See all](#)



HOME-BASED COVID-19 DETECTION KIT USING...



LOW COST, EASY POINT-OF-CARE DETECTION KIT



The One Hour Covid Test

Sarah Ware, Chris Monaco, Ellen Jorgensen

About Us



We all have scientific backgrounds

We all have started community labs

We are all passionate about accessibility to technology

We live thousands of miles apart but JOGL connects us

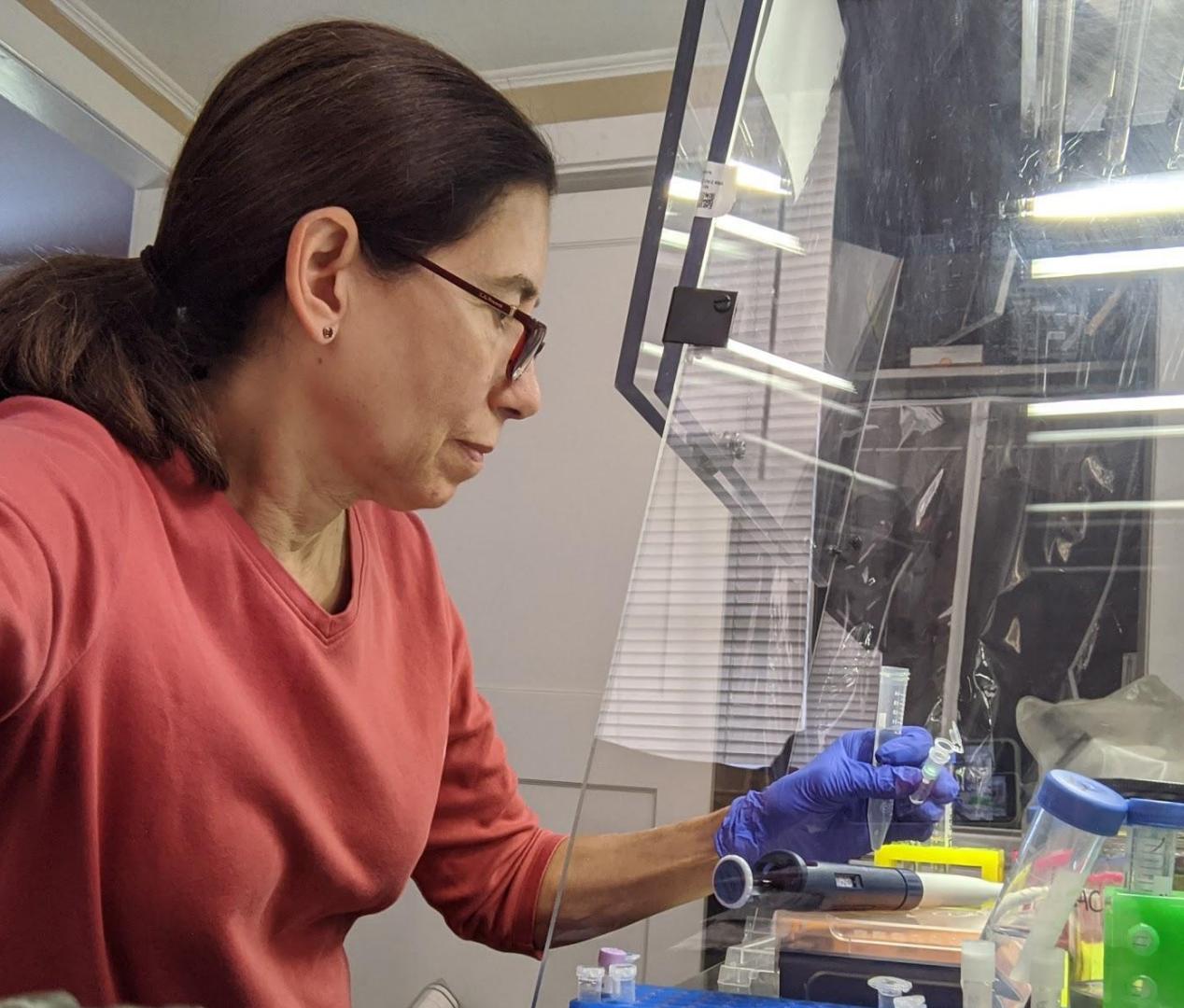
Our lives and labs are very different

We have never met each other in person

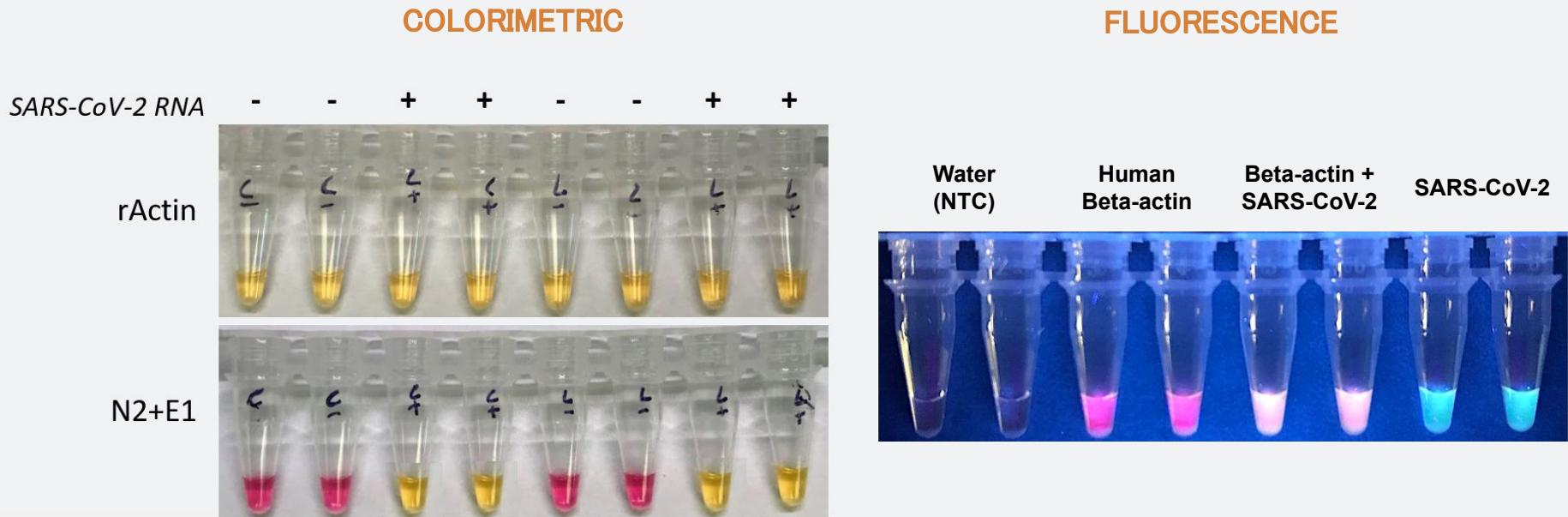
We are part of a larger JOGL diagnostics community

Where to start?

- Minimal equipment
- Available reagents
- No training
- Low Cost
- Safety & Quality
- Repeatable in 3 labs



Isothermal Amplification





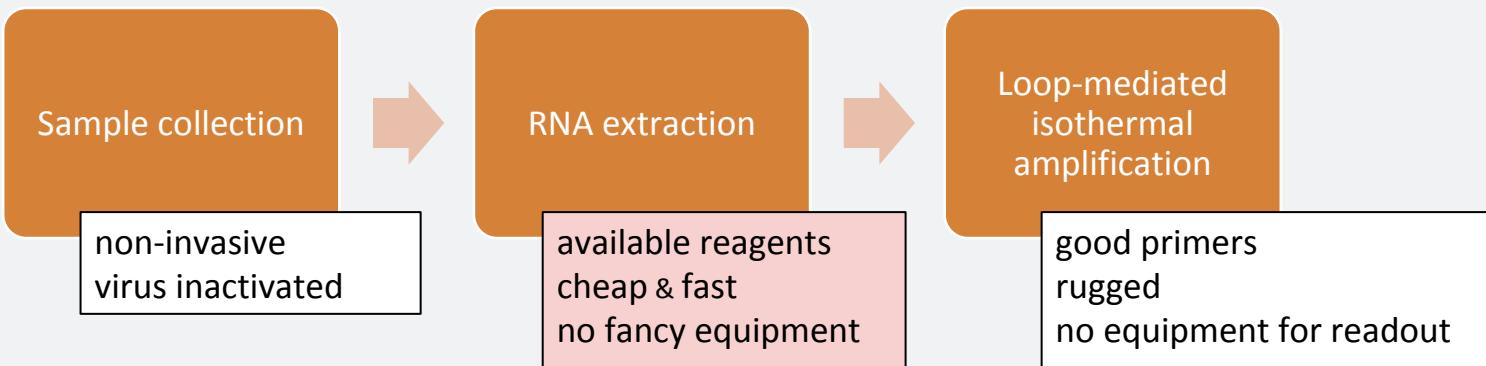
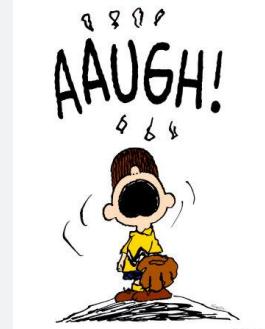
be INSPIRED
drive DISCOVERY
stay GENUINE

APPLICATION NOTE

Facilitating Detection of SARS-CoV-2 Directly from Patient Samples: Precursor Studies with RT-qPCR and Colorimetric RT-LAMP Reagents

by Andrew N. Gray, Ph.D., Guoping Ren, Ph.D., Yinhua Zhang, Ph.D., Nathan Tanner, Ph.D.
and Nicole M. Nichols, Ph.D., New England Biolabs, Inc.

Test Process



What we tried

- Alcohol precipitation
- Silica
- Paper-based
- Chaotropic salts
- Stabilization media

BEWARE PREPRINTS

Saliva-Based Molecular Testing for SARS-CoV-2 that Bypasses RNA Extraction

A simple, safe and sensitive method for SARS-CoV-2

inactivation and RNA extraction for RT-qPCR

Diana Rose E. Ranoa,^{1,2†} Robin L. Holland,^{3†} Fadi G. Alnaji,^{4‡} Kelsie

Brooke,^{2,4} Martin D. Burke,^{1,2,5,6} Timothy M. Fan,^{2,3,7} and

One-pot Detection of COVID-19 with Real-time Reverse-transcription Loop-mediated Isothermal Amplification (RT-LAMP) Assay and Visual RT-LAMP Assay A Fast and Accessible Method for the Isc Facilitate the Detection

Deguo Wang*

Jose Carlos Ponce-Rojas^{1,*}, Michael S. Costello^{1,*},
Maxwell Z. Wilson^{1,2,3}, Carolina Arias¹,

Key Laboratory of Biomarker Based Rapid-detection Technology for Food Safety of Henan Province, Xuchang University, Xuchang 461000, China

Title: Evaluation of heating and chemical protocols for inactivating SARS-CoV-2

Authors: Boris Pastorino¹, Franck Touret¹, Magali Gilles¹, Xavier de Lamballerie¹, Remi N. Charrel¹.

A rapid, highly sensitive and open-access SARS-CoV-19 for laboratory and home testing

Max J. Kellner^{1,2,3#*}, James J. Ross^{2#}, Jakob Schna Heinen^{1,2}, Irina Grishkovskaya¹, Benedikt Bauer Menéndez-Arias⁵, Robert Fritzsche-Polanz⁶, Marianna Zoufalý⁷, Manuela Födinger^{6,8}, Christoph Wenisch⁷, Diagnostics Initiative (VCDI), Andrea Pau

The Potential Use of Unprocessed Sample for RT-qPCR Detection of COVID-19 without an RNA Extraction Step

Improved and Simplified Diagnosis of Covid-19 using TE Extraction from Dry Swabs

Evaluating the efficacy of RT-qPCR S. RNA extraction

Ofir Israeli¹, Adi Beth-Din¹, Nir Paran², Milrot¹, Yafit Atiya-Nasagi¹, Shmuel Yitzl

A Rapid COVID-19 RT-PCR Detection Assay for Low Resource Settings

Arunkumar Arumug METHODS AND RESOURCES

One-step RNA extraction for RT-qPCR

Monica Sentmanat, Evguenia Kourano

Nucleic acid purification from plants, animals and microbes in under 30 seconds

Yiping Zou^{1‡}, Michael Glenn Mason^{1‡*}, Yuling Wang², Eugene Wee², Conny Turni³, Patrick J. Blackall³, Matt Trau², Jose Ramon Botella^{1*}



Use Genotek swab



prepIT reagents added



Dilute and add to
LAMP reaction

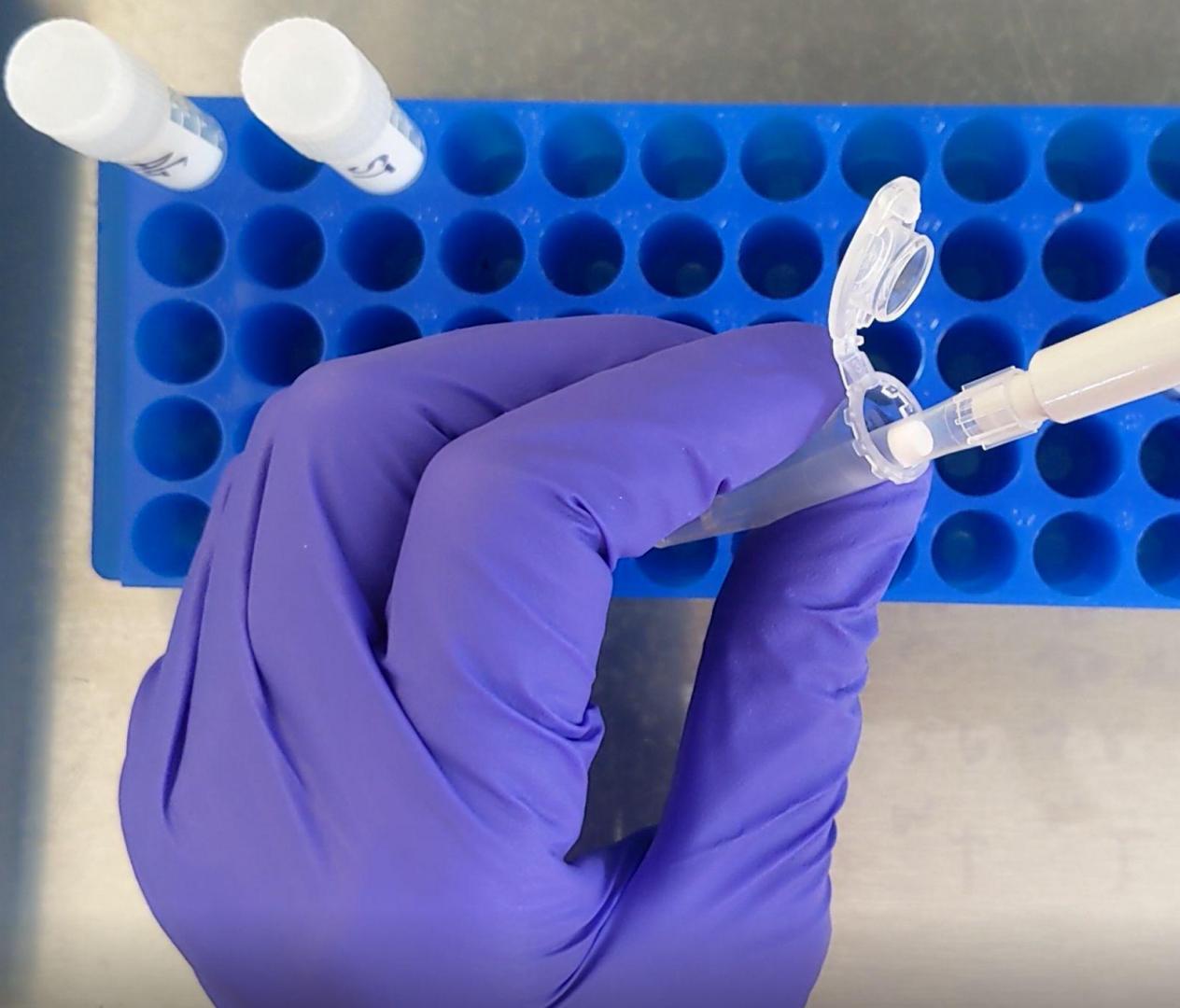
We chose speed, ease of
use & QC over DIY for
immediate deployment

The One Hour Test

What's next?

- work with JOGL partners
- fewer commercial reagents
- Open enzymes
- DNA synthesis

How far can we go in self-testing?



Corona Detective

OPEN COLLABORATIVE RESEARCH



Hackuarium



Open FIESTA Lab

GMO Detective



also supported by:



CRI

Catalysing a fruitful future



OPEN COVID19
initiative

WE CAN ALL CONTRIBUTE

Do-It-Together

SARS CoV-2



Detective



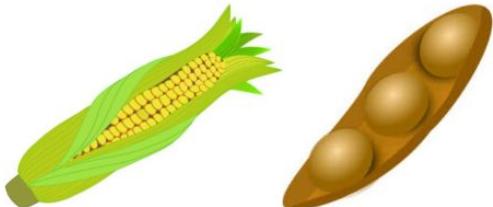
Corona Detective was inspired by the: GMO Detective



Overview

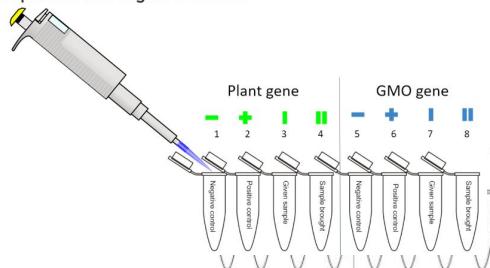
1. Choose a food you would like to test

Corn or Soy are best as these are some of the most abundant genetically engineered crops

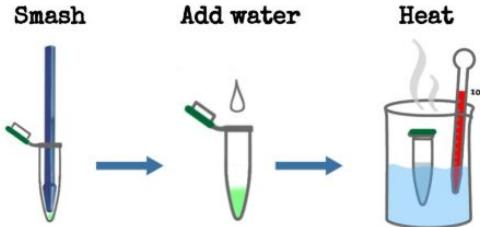


3. Transfer the DNA to the test tubes

Along with positive and negative controls



2. Extremely Simple DNA extraction:



4. Incubate

There are many simple ways to do this!



Based upon **isothermal amplification**, using reactants in a freeze-dried format for ready use.

5. Detect fluorescence



Isothermal amplification has many advantages over qPCR

(ordinarily used to detect SARS CoV-2)

Advantages

Disadvantages

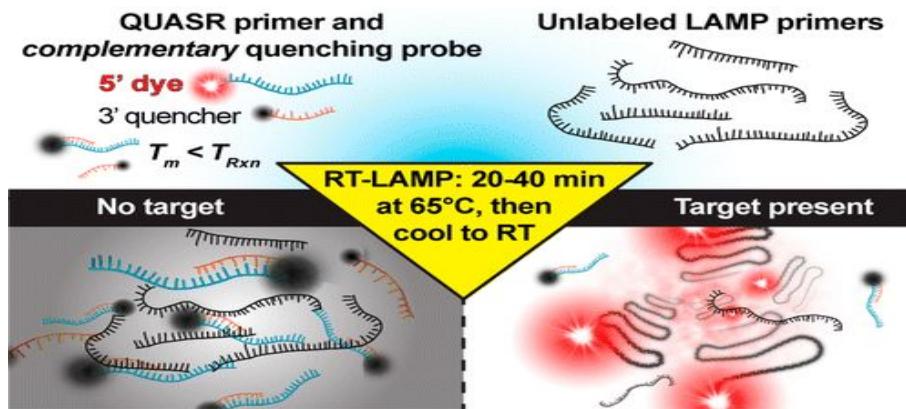
- Rapid
- Sensitive and Specific
- Isothermal
- Less



- More Difficult Primer Design
- Most Detection Methods are not Sequence-specific
- More Difficult to Multi-plex
- Products are less suitable for downstream applications (i.e. cloning, sequencing)
-but suitable detection (e.g. QUASR) can increase its use

QUASR – Quenching of Unincorporated Amplification Signal Reporters

- Solves False Positives problem
- Sequence Specific
- Allows Multiplexing



**Multiplexed detection of
West Nile virus and
Chikungunya virus**

| | | | |
|---|---|---|---|
| + | + | - | - |
| + | - | + | - |



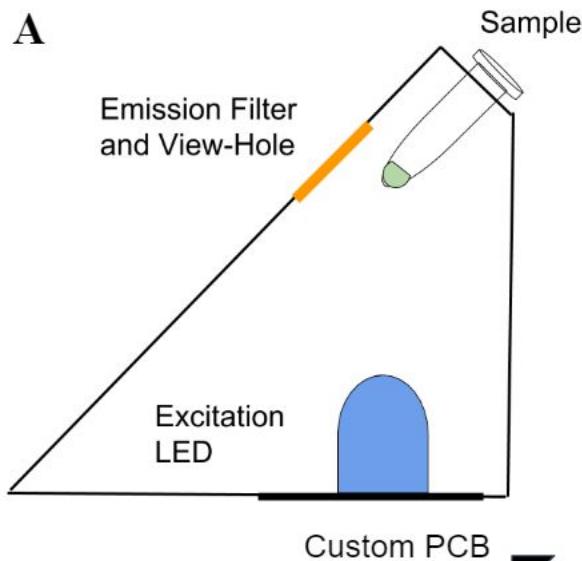
Isothermal heating reduces initial capital investment needed



The capacity of the cup is 500ML

GMO Detective's easy-to-build and use open hardware detector costs less than \$2

A



B



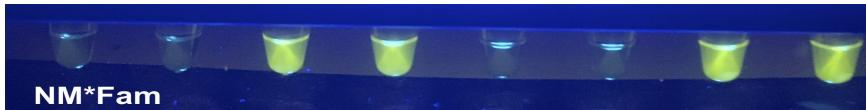
C



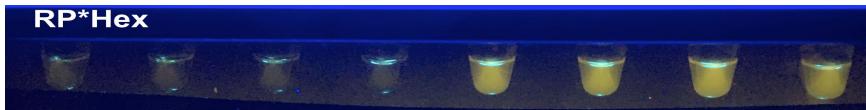
Easy interpretation of results by eye or with a camera

*Detection of green, ‘orange’ or red fluorescence
is possible with the same high-power blue LEDs*

Green



RP*Hex



‘Orange’



Red

inexpensive gel filters
can be interchanged
for different
fluorophores/colors

Lyophilization (Freeze drying) the enzymes, primers and NTPs works well, and allows storage at room temp.



This alleviates the need for a cold chain, allowing ready shipment of reaction tubes, which are easily manufactured.

(Available and affordable infrastructure at CRI Paris, already allows manufacture and testing of ~5000 reactions per day.)

Affordable to anyone anywhere

\$2 per test at a small scale (including preparation and consumables)

- can be reduced to under \$1 in large volumes.

Local manufacture and testing of thousands of samples per day can be done for less than the cost of a used qPCR machine (\$15,000), while testing thousands a day can be done even with a very minimal investment (\$500)

Open Source Enzymes



- optimization of enzyme performance and stability in open source assay
- semi-rational design
 - > utilization of evolutionary knowledge
 - > exploiting meta-heuristics
- in silico strategies:
 - > mutation screening and relaxation in Rosetta™
 - > stability assessment in Gromacs
- meet in vitro strategies:
 - > side directed mutagenesis
 - > realtime PCR benchmarking

a long term goal of Corona Detective: to avoid the need for commercial enzymes.

Sample Preparation

Different options for different contexts

Quick and easy saliva sampling for

screening of superspreaders/highly infectious individuals



Affordable, simple and effective concentration of samples for

improved sensitivity

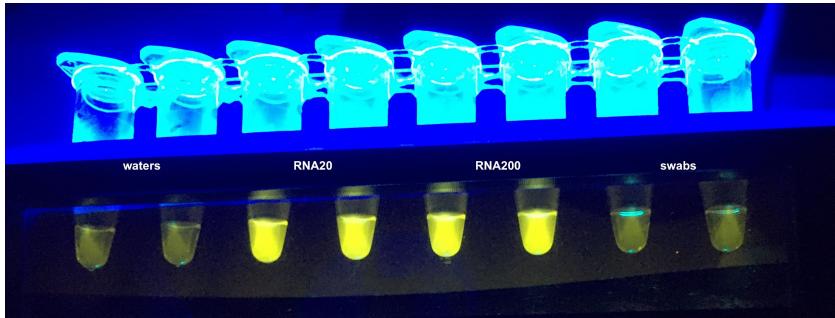


Corona Detective is Sensitive

Synthetic RNA Detection

Down to 20 RNA copies (1 copy per μl reaction).

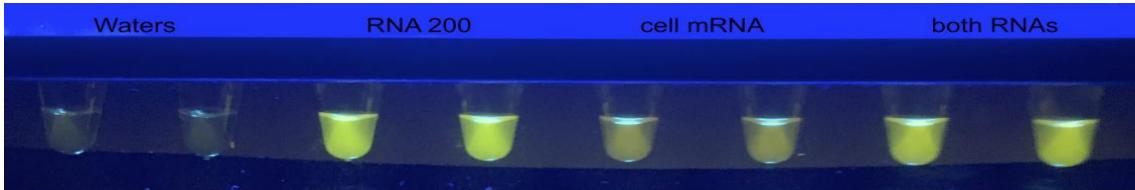
This NM primer set has already been FDA approved. (EUA)



Link to EUA announcement:

<https://www.fda.gov/media/139937/download>

Corona Detective Multiplex



- Corona NM target and RNaseP (internal RNA control) work well together for multiplexed QUASR detection
- *Future iterations of the multiplex could include:*
 - *flu virus detection (to distinguish virus)*
 - *Enterobacteria (for sewage samples)*
 - *other cell RNAs (e.g. nasopharyngeal specific)*
 - *? the next pandemic cause (hopefully not)*

All open source and collaborative

Worldwide network with an emphasis on lower resource settings

Other teams: JOGL, Reclone, Openbioeconomy lab, Mboalab in Cameroon, Sri Lanka, Ghana, Zimbabwe, Chile, etc...

Welcome to everyone

Scalable and Locally Reproducible

Data/lab notebooks available (JOGGL Open Covid 19 Initiative):

https://drive.google.com/drive/u/0/folders/1yGyS_yZaDlrF3aPXqM1MXxkyRjd9Drtl

Martin Codyre, Ireland
Kathrin Hadasch, Germany



Corona Detective | Team



Guy & Team
France



Rachel & Team
Swiss



Ellen & Team
USA



Madhavi, Kalindu, Sanjaya,
Aravinth & Team - Sri Lanka



Justin
Sarah, Christopher,
Isabella & Team
USA



Fernan & Team
Chile



Thomas, Stephane, Nadine
& Team - Cameroon

& Many more



Scott & Team
Canada



Fran & Team
Spain



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Empowering underprivileged youth in war affected regions in Sri Lanka by enabling them to solve complex local challenges on their own.

DreamSpace Academy is a Community Innovation Center to tackle local socio-economic and environmental challenges using Challenge Based Learning.



Aravinth Panch (He/His)
DreamSpace Academy / SLINTEC



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CORONA HUNTER

WHERE EVERY RNA IS LAMPED

JOGL

DREAMSPACE ACADEMY

SLINTEC



CORONA HUNTER TEAM



Dr. Sanjaya Bathige



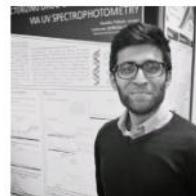
Aravinth Panch



Prof. Neelika Malavige



Madhavi Hewadikaram



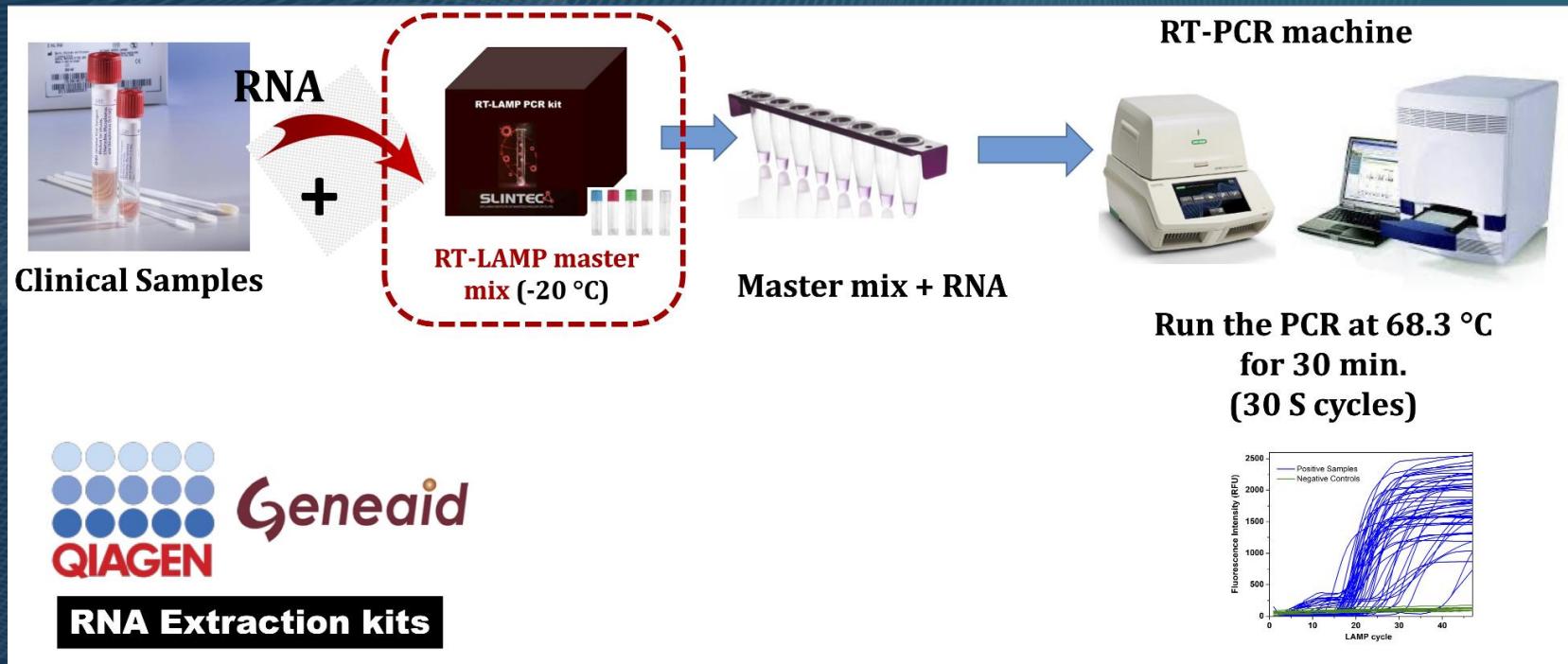
Kalindu Perera



Dr. Prabuddha Dissanayake

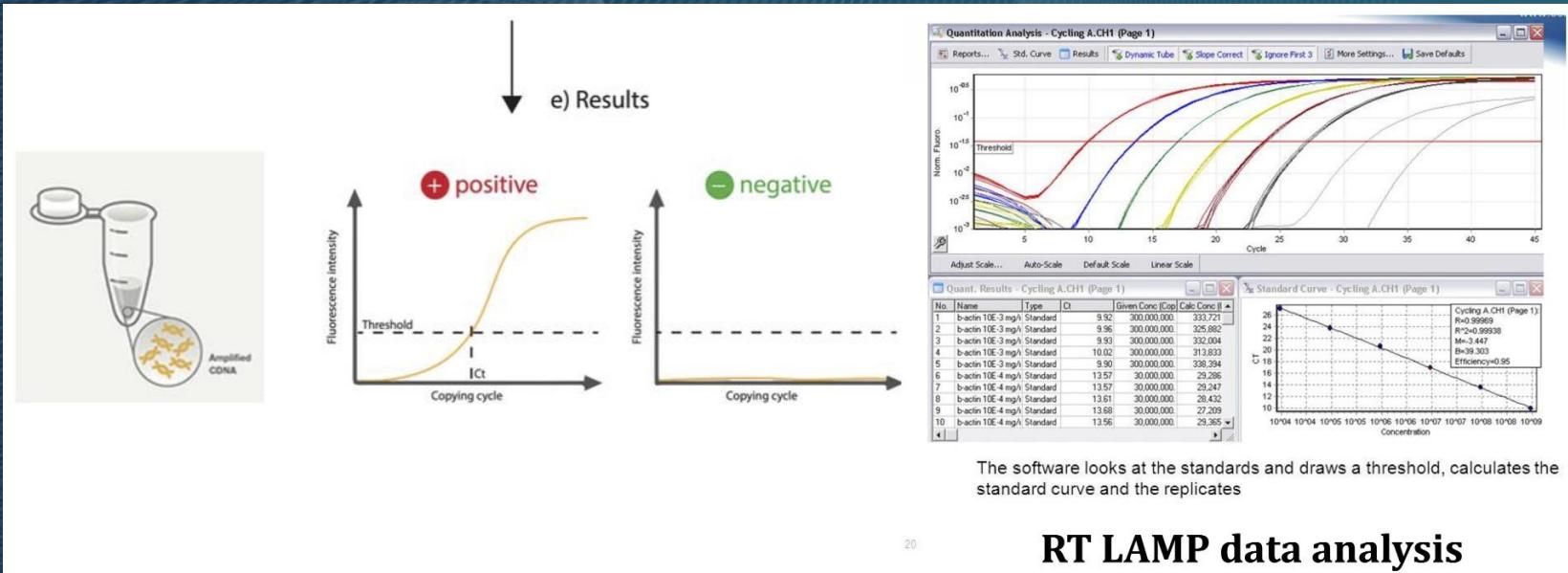


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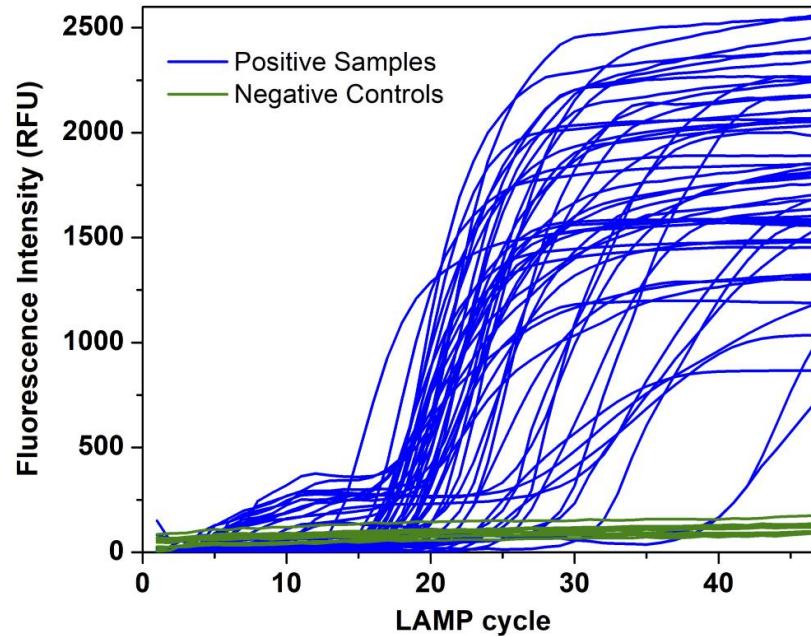
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Clinical Samples Analysis

115 Clinical Samples Tested

**Positive Percent
Agreement 97.6%**

**Negative Percent
Agreement 100%**





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- 50% cost reduction compared to RT-PCR
- 5x faster results compared to RT-PCR
- This protocol can be scaled up to conduct 500 tests per week.
- By increasing the number of RT-PCR machines utilized, the test can be scaled up to conduct 1000 tests per day with minimum effort.
- Presented to Ministry of Health and the Health Minister of Sri Lanka to launch the RT-LAMP kit at COVID-19 test centers and at the international airport in Sri Lanka.
- As a country, Sri Lanka has been very successful in managing this pandemic situation with just 13 deaths and 4500+ positive cases.



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"All Great Changes Are Preceded By Chaos"

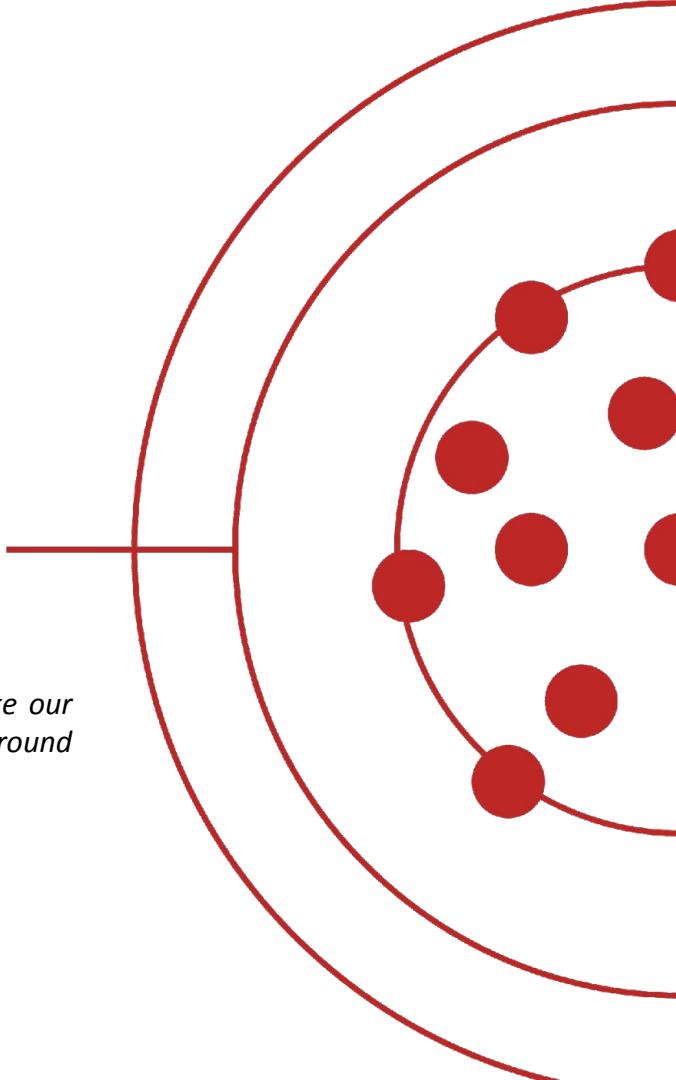
This pandemic taught us, humans, to leave all our differences behind and fight for the fundamental existence of this wonderful planet Earth. Initiative such as **OpenCOVID19** by JOGL have opened several doors with infinite possibilities, especially for the organizations and communities in the **Global South**. Such decentralized scientific cooperation has taught us to create local innovations for local problems with global support, therefore **Open Science** has truly established the international feeding grounds for the scientific hunger of the global community of scientists to make the world a better place.



COVID-19

Accessible LAMP-Enabled Rapid Test

Our international team emphasizes open scientific collaboration and aims to make our tests free from profit-driven motivations making it accessible and reproducible around the world.

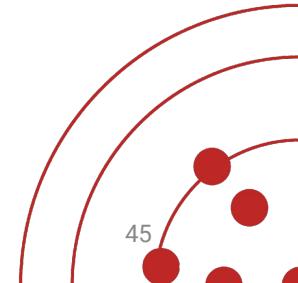




RT-PCR has been around for more than 3 decades, why have we not successfully mobilized the thousands of molecular biologists, labs and equipment in the effort to test populations?

A Triple Crisis

- 1. Health Care** Privatized healthcare in the United States is central to the diagnostics crisis.
- 2. Molecular Biology** Our educational institutions, funding agencies and intellectual property regimes make us dumber.
- 3. Hyper-Individualism** A focus on atomized individuals rather than clusters of communities fails to understand the nature and dynamics of a respiratory epidemic.





HealthCare

Accumulation over Public Health

- *QUEST and LabCorp*
- *Monopolies lead to centralization*
- *Centralization leads to clumsy.*

Molecular Biology

Technicians over Thinkers

- *Qiagen, Thermo Fisher/Invitrogen, NEB...*
- *Reagent bottlenecks and black box "kits".*
- *Enforced by an outdated intellectual property regime.*

Hyper-Individualism

Me over Us

- *Testing of individuals rather than communities*
- *Overlooking pooled sampling.*
- *Epidemics challenge individualism.*
- *....anti-maskers as freedom fighters.*

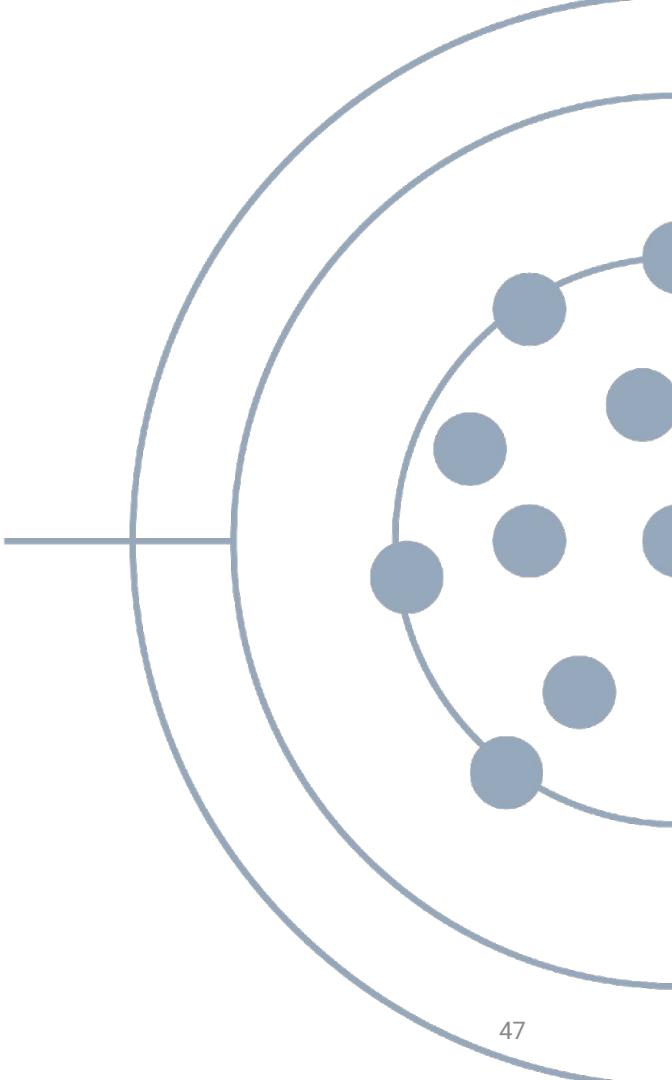
Decentralized networks for distributed self-diagnostics of communities

Distributed testing but also distributed production (enzymes, reagents, consumables, instruments).

How to ensure quality control and validation?

The only sensible way to tackle an emergent pandemic before it is well established.

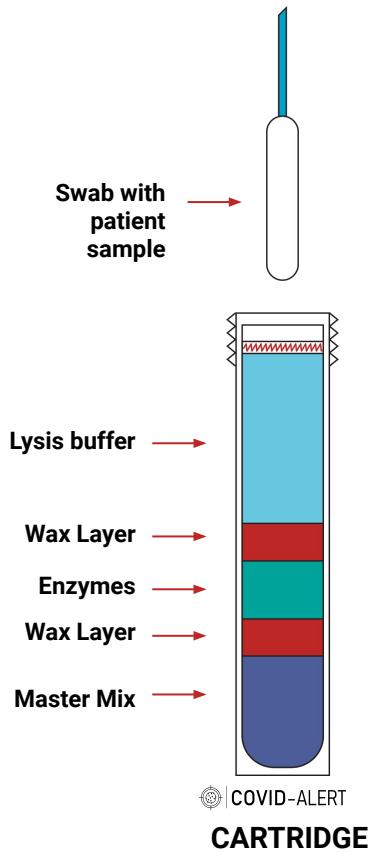
Loop-mediated Isothermal Amplification (LAMP):
an appropriate technique but we shouldn't focus only on *the means* but also on *the ends*.



- **Affordable and accessible molecular diagnostics for mass testing**
 - Inexpensive and simple yet sensitive and robust nucleic acid detection down to 25 copies per sample and less than \$2 per test.
 - Self-testing: no centralized laboratories or trained technicians.
 - Local and distributed production of **public domain enzymes**.
 - Ambient temperature shipping and storage for at least 1 month to simplify last mile distribution.
- **Automated mass manufacturing that is robust to supply chain disruption**
 - Cartridges can easily be scalable with automated mass production.
 - Major innovation using readily available, inexpensive waxes with diverse supply chains.
- **A universal platform** easily adaptable for other viruses and microorganisms.



Diagnostic Cartridges *Simple but Sensitive and Robust*



Seal broken as sample enters test chamber

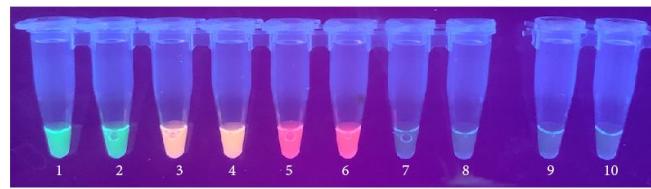
Wax melts once chamber reaches 65°C

Sample material mixed with enzyme and master mix

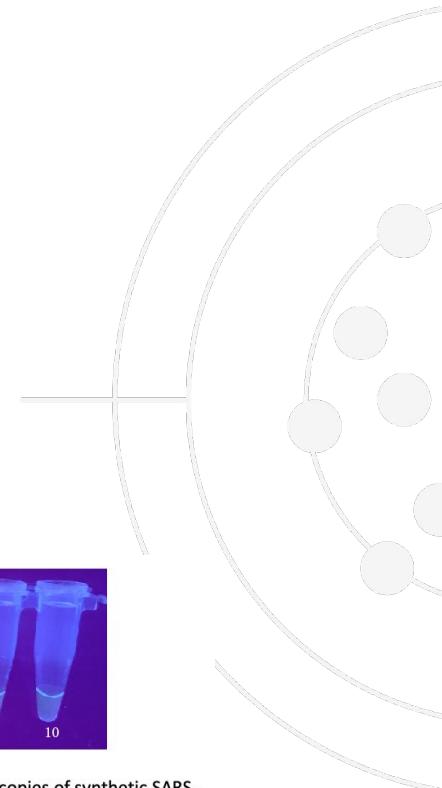
Incubation for ~1hr



1-2 Nasal pharynx flushthru (NFT) RNA extraction, 3-4. Nasal pharynx flushthru (NFT) RNA extraction and 2000 copies of synthetic SARS-CoV-2 RNA, 5-6 4000 copies of synthetic SARS-CoV-2 RNA, 7-8 No template water controls



1-2 0.4ng of Influenza B RNA, 3-4 0.2ng of Influenza B RNA and 2000 copies of synthetic SARS-CoV-2 RNA, 5-6 4000 copies of synthetic SARS-CoV-2 RNA, 7-10 No template water controls





COVID-ALERT

Just One Giant Collaboration with JOGL

1

Thinking together through technical and scientific challenges

- Convening an intellectual, scientific community with shared priorities

2

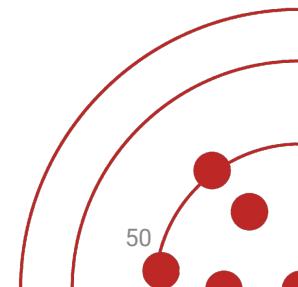
Facilitating our projects

- Microgrants
- Clinical Validation

3

Building our teams

- Finding each other





COVID-ALERT Alternative Visions of Diagnostics

We are building the tools but what will they be used for?

Biopolitical Control



(Re-)Enforcement of existing social hierarchies

Biopolitical Freedom



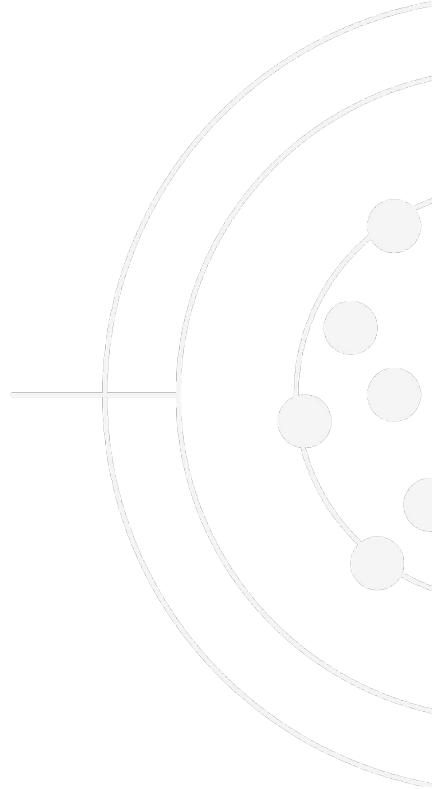
Abolishing existing social hierarchies



Our answer is a question

The answer to solving the testing crisis is the same question that answers why, I assume, most of us are attending the [Global Biosummit](#):

HOW CAN WE TRULY DEMOCRATIZE MOLECULAR BIOLOGY?





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Xprize Promo Video

<https://youtu.be/Tdfws3g3R2s>



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Open Bioproduction

Open Enzyme Production Optimization and Purification for COVID19 Diagnostics

- Kathrin Hadasch
(epiLAB/Lab³) Germany
- Scott Pownall (Open
Science Network Society)
Canada



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Quantified Flu: Using wearables to predict infections

Bastian Greshake Tzovaras
[CRI Paris, Open Humans]



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How to foster successful virtual collaboration: Learnings from Open COVID19 Round Table

- Thomas Landrain (JOGL)
- Rachel Aronoff (AGiR! / Hackuarium)
- Sarah Ware (BioBlaze Community Bio Lab)
- Guy Aidelberg (CRI Paris)
- Ellen Jorgensen (Aanika / Biotech Without Borders)
- Aravindh Panch (DreamSpace Academy / SLINTEC)
- Ali Bektaş (Oakland Genomics Center)
- Martin Codyre (GiantLeap Biotechnology)
- Kathrin Hadasch (EpiLab)
- Scott Pownall (Open Science Network)