How this came about (March 2020):

- No coordinated infrastructure exists that allows for access to quality serological reference materials
- At least 145 COVID-19 antibody test kits were listed with no quick way to assess their quality (the list grew to over 400)
- Diagnostic test unreliability in general was leading to deterioration of trust in the results
- Recognize the need to improve and maintain quality laboratory test
Guiding Principles

• Equitable access and fairness - Providing equal access to all regions, both public and private testing facilities, for the improvement of COVID-19 serological testing

• Collaboration and support – Working with organizations and institutions to support a global resource for quality COVID-19 serological testing

• Transparency and sharing – Sharing of information and protocols for better understanding and improvements to the quality of COVID-19 testing

• Sustainability and country ownership – Create a virtual biorepository and to transfer technology to countries and organizations to bring access to quality materials
A conceptual design of a more sustainable and enduring infrastructure
Objectives

▸ Provide a quick overview of the CSCP.
▸ Define the process used to develop the CSCP.
▸ Discuss the validation of the CSCP.
   ▸ Share preliminary findings
▸ Discuss our current standing and next steps.
The CSCP is a kit of 5 well characterized and validated Dried Tube Specimens for labs to use as a resource to:

- COVID-19 Serology Test Comparisons
- Quality Control
- Training Material
- Multi-Center Research Studies

**Goal:** Track the performance of COVID-19 serology diagnostic tests for quality and consistency.
What are Dried Tube Specimens (DTS)?
Benefits of DTS

- Kit is stable at a wider temperature range.
  - ~1 month between -20°C and 37°C

- Simplifies sample transport and storage logistics as there is no cold chain requirement
1. Secure pre-screened high-titered SARS-CoV-2 convalescent plasma and 2 pre-pandemic donors from blood bank source under research protocol.

2. Characterize donor plasma reactivity to SARS-CoV2 antigens and screened against seasonal human CoVs, SARS, MERS.

3. Select the top candidates:
   - 3 Highly reactive
   - 2 Non-reactive

4. Develop the pooling strategy:
   - For High Positive & Medium/Low Positive
   - Test the pools

5. Produce >2,500 CSCP Kits:
   - Test the CSCP Order & Resulting System
   - Establish Long Term Stability

6. Make available to Users globally. Users data/results are anonymized:
   - Compile findings and share aggregate results
Lab 1
Method(s) used: ELISA HE-ELISA
Antibody(s): IgM IgG
Antigen(s): Nucleocapsid

Lab 2
Method(s) used: ELISA
Antibody(s): IgG
Antigen(s): Nucleocapsid Receptor Binding Domain

Lab 3
Method(s) used: Focus-Reduction Neutralization Test
Antibody(s): Total Ig
Antigen(s): Total Virus

Lab 4
Method(s) used: Pseudo-Virion Neutralization Assay
Antibody(s): Total Ig
Antigen(s): Spike

Lab 5
Method(s) used: Nano-bead microarray
Antibody(s): IgG
Antigen(s): Nucleocapsid Receptor Binding Domain
Our results so far represent a small number of tests being deployed in research and diagnostic testing, but mirrors the types of platforms being used.
Plasma Pooling Results
Lab 1 ELISA: High vs Medium/Low Positive Pooled Plasma Results

Lab 2 ELISA: High vs Medium/Low Positive Pooled Plasma Results

Lab 3 FRNT: High vs Medium/Low Positive Pooled Plasma Results

Nucleocapsid

Receptor Binding Domain

Whole Virus

47% Reduction

59% Reduction

51% Reduction

39% Reduction
Liquid vs Dried Tube Specimen (DTS) Comparison

- Compared using the Epitope Diagnostics COVID-19 serology platform.
- DTS undergo 1:10 dilution during rehydration step.
- Liquid specimen comparable to DTS

<table>
<thead>
<tr>
<th>OD values</th>
<th>Positive Cut-off</th>
<th>Negative Cutoff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.29</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Medium/Low Positive Pools: DTS vs Liquid Reactivity

High Positive Pools: DTS vs Liquid Reactivity
Long Term Stability Results
-20C Long Term Stability Results

Ambient Temperature (22-25C) Long Term Stability

37C Long Term Stability

Strong Positive
Weak Positive
Negative
OD Positive cutoff

Strong Positive
Weak Positive
Negative
OD Positive Cutoff

Week 1 Week 2 Month 1 Month 2

Week 1 Week 2 Month 1 Month 2

Week 1 Week 2 Month 1 Month 2

Week 1 Week 2 Month 1 Month 2
Example CSCP User Result Form
<table>
<thead>
<tr>
<th>Correct</th>
<th>Incorrect</th>
<th>Interpretation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>🟢🟦🟦</td>
<td></td>
<td>Your serology test agreed with expected reactivity</td>
<td>Performance compatible with expected results</td>
</tr>
<tr>
<td>🟢🟦</td>
<td>🟦</td>
<td>Medium level antibody was not detected during testing</td>
<td>May indicate sensitivity level of test platform is lower than expected</td>
</tr>
<tr>
<td>🟢🟦🟦</td>
<td></td>
<td>1 of 2 identical Medium level antibody agreed with expected reactivity</td>
<td>May indicate test performance or reconstitution error</td>
</tr>
<tr>
<td>🟢</td>
<td>🟦</td>
<td>1 of 2 identical Negative results did not agree with expected reactivity</td>
<td>Suggest that reconstitution of DTS was problematic</td>
</tr>
<tr>
<td>🟢🟦🟦🟦</td>
<td></td>
<td>Your serology test does not agree with expected reactivity</td>
<td></td>
</tr>
</tbody>
</table>
Current Status of the COVID-19 Serology Control Panel

- We have launched for Users

- If Interested, follow the instructions ➔

- Or visit the following link to request a kit for your lab:
  https://docs.google.com/forms/d/e/1FAIpQLSdLHPMGiNTJgdrikp2Bq16x3DfkzarOnW4wwCro0GcF_WO8sw/viewform

- The University of Colorado Center for Global Health website:
Here is what a CSCP Kit looks like

Assembled

Disassembled
CSCP Status & Next Steps
CSCP User Results So Far…

- **Strong Positive**
- **Medium/Low Positive**
- **Negative**

**Correct** vs. **Incorrect**
Next steps:

- Continuous accretion and analysis of CSCP kit results.
  - Test in parallel with other standards (including NIBSC International Standards)
- Embed CSCP kits as part of lateral flow test kits being rolled out in African region
  - Coordinating with grassroots labs
- Creating other screening panels: Zika, dengue
- Launch a virtual biorepository as a global good infrastructure
Questions?

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