COVID-19 NC Collaboratory Projects

Your project summary has been reviewed by the COVID-19 NC Collaboratory Projects review team. The review team would like additional information about your project. Please provide the following by close of business, May 21.

Impact to the State (300 word limit)

- Description of the problem or challenge being addressed and how the problem impacts those in the state of North Carolina
- Describe how the proposed research will provide impactful solutions to the described problem to help the state of North Carolina

A robust North Carolina economy supports its population on every level notably including public health, food supply, and education. The re-opening of commerce, maintaining the high-volume pork production industries, and continuation of classroom education must be done carefully using appropriate and cost-effective scientific tools to reduce the risk of follow-on waves of infection and subsequent re-closure. Public health officials concur that large-scale, accurate, and sensitive diagnostic testing is a linchpin to the resumption of economic and educational activities and the importance of such testing will increase with the onset of seasonal flu. Combined with contact tracing, it can inform interventions to limit quarantining or disruption to identified activities. Moreover, the diagnostic testing must be rapid and low-cost to allow widespread use.

Our proposed research plan will address the diagnostic testing issues, most notably large-capacity, low-cost testing of a broad spectrum of respiratory viruses with state-of-the-art sensitivity and precision. We will also demonstrate the use of the same platform for broad spectrum serology assays to provide insights on immunity through prior infection or vaccination. Our proposed effort will take advantage of ≈$25M in federal and state supported research and development that has transpired over the last decade at UNC-Chapel Hill. We have been able to develop a significant patent portfolio during the course of our research and plan on spinning out a company around this technology. We propose placing this company in the RTP area to generate further economic impact for NC. Interestingly, we have recently had discussions with a strategic investor in the diagnostics space who has indicated that if we can complete both genetic and serology tests that includes SARS-CoV-2 in less than four hours that they would invest in our technology. We believe we will be able to perform these tests in less than two hours!

Milestones (300 word limit):

Description of what will be accomplished and what can be delivered by August 31, 2020, and by Dec. 31, 2020. The start date will be June 1, 2020.

August 31,2020 Milestones

- Integrate ≈12 primer pairs for SARS-CoV-2 into a multiplex digital array PCR (daPCR) assay using published sequences
    - Develop against standards
    - Validated against a limited number of remnant samples from UNC Clinical Molecular Microbiology Laboratory (Miller) tested for SARS-CoV-2 using an FDA-authorized assay.
    - Down select to best performing 2-4 primer pairs for SARS-CoV-2 detection and quantification
- Revive existing 12-multiplex respiratory assays for endemic viruses
    - Test against standards and remnant samples
- Identify up to 12 candidate antigens specific to SARS-CoV-2, SARS-CoV-1, and endemic coronaviruses.
    - We will identify a total of ≈12 candidate antigens for SARS-CoV-2, SARS-CoV, and endemic coronaviruses (Lakshmanane).
- Assemble antigen panel into our immunoPCR assay protocol.
    - Preliminary validation using positive serum. Assess quantitative abilities.

Dec, 31, 2020 Milestones

- Integrate SARS-CoV-2 assays into our existing respiratory panel.
    - Demonstrate ease of aggregating assays by adding the best performing (2-4) SARS-CoV-2 assays to our multiplexed respiratory panel and test against standards
    - Test full panel against remnant samples that have been tested for SARS-CoV-2 and endemic viruses using FDA authorized assays (Miller).
- Implement multiplexed respiratory panel including SARS-CoV-2 into high throughput assay platform.
    - Test against remnant samples (Miller) and surveillance studies taking place at UNC-CH (Jones) to showcase the speed, accuracy, and throughput of the platform, and
    - Perform testing to further an FDA submission.
- Test the antigen panel against remnant serum samples to determine the SARS-CoV-2 antigens and endemic coronavirus antigens with the most diagnostic utility.
    - Utilize SARS-CoV-2 positive remnant samples provided by the Clinical Microbiology/Immunology Laboratories at UNC Hospitals (Schmitz) to identify the best antigens for use in a SARS-CoV-2 antibody assay.
    - Perform time course studies to determine the earliest possible identification of SARS-CoV-2 antibodies.

Budget Justification (200 word limit): Funds are limited. We encourage all teams to revisit their budget and determine if it can be reduced.

- Please also complete the provided budget template (attached)

- **J. Michael Ramsey, Ph.D., Principal Investigator.** Minnie N. Goldby Distinguished Professor of Chemistry at the University of North Carolina-Chapel Hill (UNC-CH) with joint appointments in the Departments of Biomedical Engineering and Applied Physical Sciences; Lead PI

- **Melissa B. Miller, Ph.D., D(ABMM), F(AAM), Co-PI.** Professor, Pathology & Laboratory Medicine and Director, Clinical Microbiology and Molecular Microbiology Laboratories; Clinical advisor and provider of SARS-CoV-2 remnant samples

- **Corbin Jones, Ph.D., Co-PI.** Professor of Biology; Co-PI of COVID-19 Employee and trainee Surveillance Project and provider of SARS-CoV-2 surveillance samples

- **Prem Lakshmanane, PhD, Advisor.** Research Assistant Professor in the de Silva Laboratory. Provider of SARS-CoV-1 and SARS-CoV-2 antigen selection and acquisition.

- **John L. Schmitz, PhD, D(ABMLI, ABHI), F(AAM), Co-PI.** Professor of Pathology & Laboratory Medicine and Microbiology/Immunology; Provide serum samples from COVID-19 positive and negative patients, and longitudinal samples from positive patients.

- **William H. Henley, Ph.D., Senior Scientist. Co-PI** and technology lead

- Assay development: **Angela Proctor, Ph.D.,** Research Scientist**; David Korest,** Research Technician; **Xuefei Gao, Bidhan Dhar,** Postdoctoral Researchers

- Platform development: **J.P. Alarie, M.S.,** Research Scientist**; John Perry**, **Ph.D.,** Research Scientist; **Andrew Hoerter,** Senior Software Engineer, **Sokkhen Prom,** Senior Mechanical Engineer**; Michael Pynn,** Senior Electrical Engineer**; David Thrower,** Research Staff **Yury Desyaterik,** Staff Scientist

- **Materials and Supplies**

▪ Specialty Biochemicals	$7,188
▪ Assay Controls	$1,522
▪ General Lab Supplies	$ 709
▪ Total	$9,419

- **Patent Costs** **$125,000**

  The technology used in this research has been developed with ≈$25M in R&D support to date, mostly from DoD. Seven families of patents have been developed from these research activities. Patent applications have been submitted to the US, EU, China, and Japan and the seminal patent has been issued in US, China, and Japan. The DoD

continues to support the development of this technology through a contract with DTRA. Their continued support will be based upon our ability to translate the technology development into the private sector. UNC has been supporting the patent portfolio since 2012, but this support is terminating in 2020. A patent portfolio protecting technology is a requirement for seeking interest from investors to form a start-up company that will eventually supply the commercial products to the private sector and DoD. We plan on placing the company in RTP. There are currently two venture finance entities and a strategic investor expressing interest in our technology. It is crucial that we keep this patent portfolio intact.

EHRA Salary	$ 125,527
SHRA Salary	$ 7,875
Postdocs	$ 56,523
Grad Student	$ -
Temps	$ -
Fringe Pool	$ 52,911
Non-Personnel Expenses	$ 134,419
Total	$ 377,255