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# Biosensors and Diagnostics for Pandemic Response

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# About myself and Sandia Biosciences

Robert Meagher, Ph.D.

- Principal Member of Technical Staff
- 16 years at Sandia, starting as a postdoc
- Research interests: Microfluidics, nucleic acid amplification, virus detection

## Sandia Biosciences

- Interdisciplinary research groups located both in Livermore, CA and Albuquerque, NM
- Broad mission areas are **Biodefense and Emerging Infectious Disease** and **Bioenergy**
- Traditionally has leveraged Sandia capabilities in device & systems engineering for applications in **Biosensors, Diagnostics, and Detection**, including early foundational work in microfluidics
- The Biosciences groups collaborates broadly with other programs in Sandia, including programs in systems analysis, homeland security, global biosecurity, and other areas

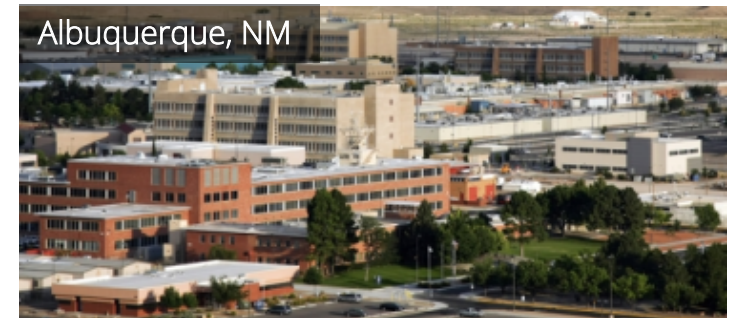
Pre-pandemic (c. 2016)



Livermore, CA



Albuquerque, NM





# Sandia Diagnostics for COVID-19 Response



- Starting in March 2020, Sandia as well as DOE Office of Science saw an urgent need to respond to the growing COVID-19 pandemic in the USA.
- Numerous efforts within Sandia and across the DOE Labs were rapidly initiated, leveraging multiple capabilities within the national labs (not just diagnostics).
- Two specific technologies that I have been involved with:
  - Viral RNA detection – QUASR / Smart LAMP
  - Viral protein / antibody detection - SpinDx





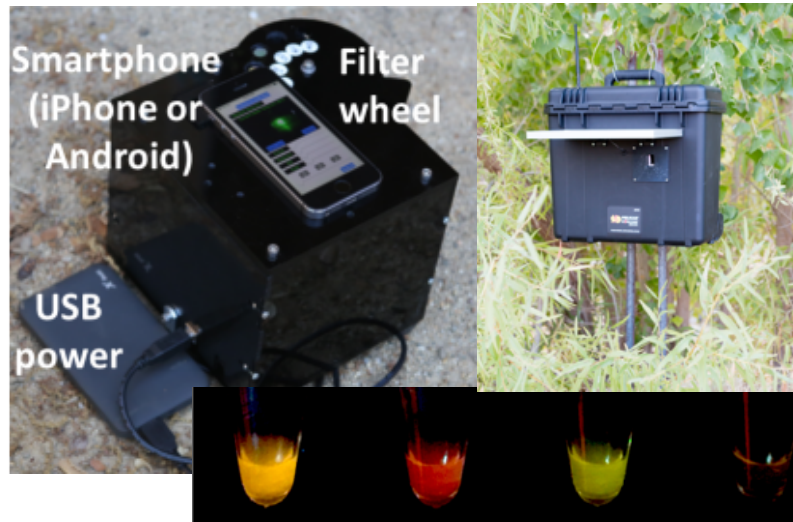
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# "QUASR" and Smart LAMP – Rapid Viral RNA detection

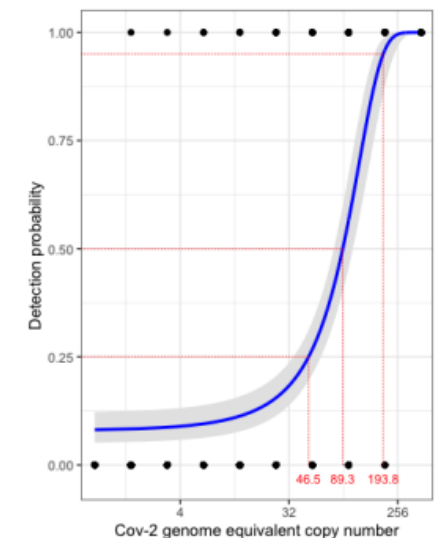
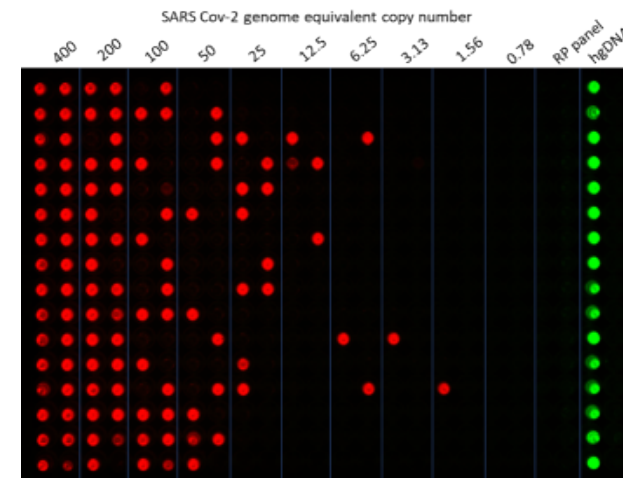


- From previous research (LDRD, DTRA, and NIH funding), we had been working with isothermal diagnostics (LAMP), especially focused on arbovirus detection, and worked to advance:
  - "Direct" amplification from viruses (circumventing extraction)
  - "QUASR" detection chemistry that enabled much higher specificity as well as very bright signals that could be discerned with simple instrumentation, e.g. smartphone.
- We pivoted to SARS-CoV-2 detection, and are currently seeking commercialization opportunities.
- But we're also interested in advancing the basic science of isothermal amplifications.

Smart Trap, Smart LAMP, QUASR for arboviruses (2013-2017)  
(collaboration with UC Davis / Prof. Lark Coffey)



SARS-CoV-2 Detection & Diagnostics  
(saliva, swabs, environmental)







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# SpinDx – Portable instrument for multiplexed immunoassays

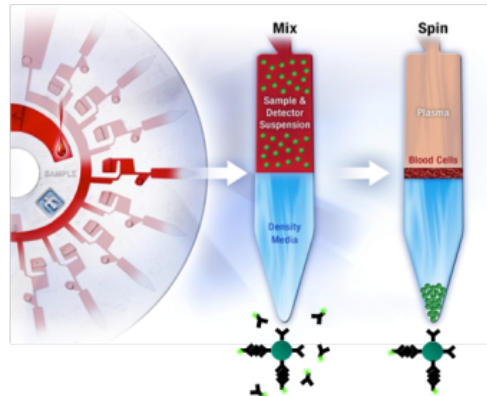


- Sandia began developing “SpinDx”, a portable bead-based sedimentation immunoassay, around 2009
  - Numerous applications in biodefense, emerging infectious disease, bioenergy
  - SpinDx enables quantitative, multi-analyte immunoassays and even parallel immunoassay + nucleic acid assay
- SARS-CoV-2 pandemic has brought serology and direct antigen “test strips” into common use
  - Test strips are easy to use, but have many challenges as well.
- Recent collaboration with Prof. Cristina Davis on biomarker discovery, which could lead to new targets for SpinDx assays.

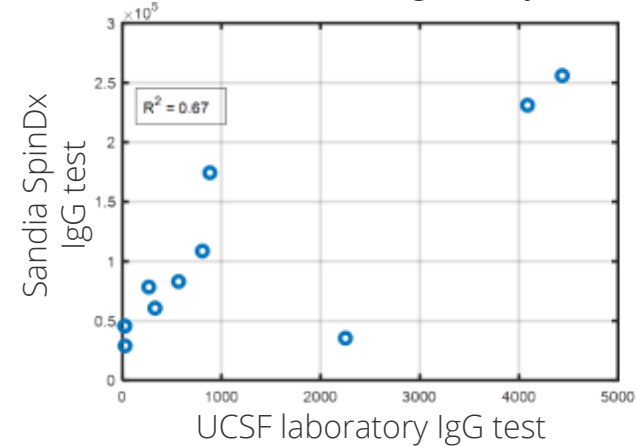
SpinDx prototype reader



Bead-based assay principle



SARS-CoV-2 IgG Assay



Ebola virus RNA assay

