THE KNOWLEDGE FOUNDATION'S SECOND ANNUAL

BIODEFENSE WORLD SUMMIT 2016

June 27-30, 2016 | Hilton Baltimore | Baltimore, MD

SPEAKER Q & A

On June 28, Harshini Mukundan from Los Alamos National Laboratory will be presenting on the application of novel assay strategies, which she developed with her team, using a waveguide-based biosensor platform to the diagnosis of tuberculosis and other diseases. The Knowledge Foundation recently spoke to Dr. Mukundan about her upcoming presentation, "Pathogen Biomarkers for Rapid Clinical Diagnosis in POC," taking place at the Biodetection Technologies: Point-of-Care for Biodefense conference to be held June 28-29, 2016, as part of the 2nd Annual Biodefense World Summit in Baltimore, MD.

Dr. Mukundan is a scientist and principal investigator at the Los Alamos National Laboratory. Following a PhD in biomedical sciences and three year industry experience developing hand held robust sensors for pathogens, Harshini joined Los Alamos with a prestigious NIH post-doctoral fellowship. Her team is focused on the development of ultra-sensitive and specific detection assays for pathogens of interest to global health and national security. The research effort of the multi-disciplinary biosensor team focuses on engineering new sensor systems (waveguide-based optical biosensor platforms), transduction schemes (membrane insertion technology), functional surfaces (silane based self assembled monolayer chemistry), recognition ligands (recombinant antibodies, carbohydrates and aptamers) and fluorescence reporters (quantum dot conjugated recognition ligands). This integrated approach has been used to develop diagnostic assays for agents such as mycobacterium tuberculosis, bacillus anthracis, serotype specific detection of influenza viruses, and others. More recently, the team has been working to develop rapid diagnostics for Shiga-toxin carrying E. coli, a concern to the beef industry, and extending the technology for M. tuberculosis detection to full-scale clinical studies, among others. The team is also interested in using the strategies developed to understand host-pathogen biology, especially in the context of innate immune recognition of pathogen associated molecular patterns during infection, processes that have significant impact on the design of both vaccines and countermeasures.

Q: Can you tell us a little about yourself and your work?

I am a scientist and team leader at the Los Alamos National Laboratory. I have a masters in microbiology from India, and a Ph. D in Biomedical Sciences in the USA. After graduating, I worked for two years in a startup biotechnology firm developing rapid assays for detection of biological threat agents before joining the Los Alamos National Laboratory as a NIH post-doctoral fellow. I was subsequently converted to staff scientist and have stayed on in the laboratory, leading multi-disciplinary detection, diagnostics and biosurveillance efforts. Our team is focused on developing, validating and deploying diagnostics for diseases such as tuberculosis in endemic populations of the world, with high disease burden. In addition, we are interested in exploring and characterizing real-world challenges to diagnostics and epidemiology such as the impact of co-morbidities and co-factors. We chose to do this by studying the interplay of several diseases in high disease burden regions of the world. On the other hand, we are also working on developing novel remote biosensing capabilities using adaptations of the sensors currently used Mars, on the curiosity Rover!

Continued on back...

To learn more about her presentation and the Biodefense World Summit, visit **BiodefenseWorldSummit.com/Biodetection-Technologies**

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Q: Why are you attending the Biodefense World Summit and what are you looking forward to at 2016's Summit?

I have been attending and watching the evolution of this conference series for about five years now, and am extremely interested in knowing more about the work being done at the interface of diagnostics and detection technology development, and biosurveillance implementation. The conference presents one of the unique venues to achieve that. Further, understanding the government perspective and industry interests in one single conference is also extremely valuable. I am looking forward to learning more about the development in point-of-care diagnostics development, and the information exchange between genomics and non-genomics technologies at this conference. Another unique aspect of this conference is the focus on integration of diagnostics with a follow on conference on biosurveillance.

Q: Can you tell us a little about your work and why you chose to tackle this topic?

While developing diagnostics for infectious diseases, two different things became increasingly apparent.
1) Our innate immune system has figured out how to detect infection very early in onset, and discriminate self from foreign irrespective of whether the pathogen is natural, engineered or drug-resistant.

2) Animal models and in vitro studies suffer from poor efficacy in many cases when applied to clinical samples.

3) More than a single disease, it is the interplay of various co-existing conditions that control incidence, outbreak, and diagnostic success.

Therefore, we decided to develop a universal strategy for diagnostics of infectious diseases by modeling innate immune recognition in vitro! To evaluate this, we decided to study the methodologies directly in human samples in high disease burden populations, while incidence of other co-morbidities such as HIV and malaria is also rampant. I will talk about the impact of this approach on the development of diagnostics for many diseases, including tuberculosis, which is in clinical validation right now. The information garnered at a population level, and the parameters mentioned above, also apply to surveillance of outbreaks and I will discuss the development of biosurveillance strategies inclusive of co-morbidities in the talk in the BSV symposium.

Q: What are the major obstacles and what's revolutionizing your field of research

In many cases, benchmarking the assays, to the lack of suitable gold standards is a huge roadblock. If we do not know what the ground truth is, how do we measure success? In others, lack of reagents (antigens, antibodies, primers, what have you...) is a limitation and we have had to create inventories or form alliances to make progress using our methods in such cases. What is revolutionary is the development of methods to measure pathogen-specific signatures in clinical samples by accounting for their biochemical properties, and the consequent impact on host-pathogen association. By being cognizant of this interaction, we have identified universal and common patterns of pathogen biomarker-host carrier interactions, which have allowed for the development of broad based methods that transcend many diseases.