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Have We Finally Turned the Corner in Rapidly Diagnosing Tuberculosis Infection and Disease?

Edward A. Graviss[1*], Ye Hu[2]

[1]Houston Methodist Research Institute, Department of Pathology and Genomic Medicine, USA

[2]Arizona State University, School of Biological and Health Systems Engineering, Virginia G. Piper Biodesign Center for Personalized Diagnostics, The Biodesign Institute, USA

[*]**Corresponding authors:** Edward A. Graviss, Associate Professor, Institute of Academic Medicine, Department of Pathology and Genomic Medicine, Houston Methodist Research Institute, 660 Bertner Avenue, R6-117, Houston, TX 77030, USA. Tel: +1-7134414323; Fax: +1-7134413599; Email: eagraviss@houstonmethodist.org

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Tuberculosis (TB), caused by *Mycobacterium tuberculosis* (Mtb), is the most prevalent and deadliest infectious diseases worldwide, accounting for 10.4 million new cases and nearly 1.7 million deaths in 2016 [1]. Conventional TB screening and diagnostics suffers from low sensitivity and specificity, high-cost, and time to results, including GeneXpert, TB acid fast culture and smear, the Tuberculin Skin Test (TST) and Interferon-Gamma Release Assays (IGRA). The use of rapid and reliable multiplexed detection methods to diagnose the spectrum of TB at its earliest stages of development and transcending from infection to disease are desperately needed. Significant work to this end (as described below) has begun with the utilization of nanoscience research.

Mtb-specific antigens, such as Early Secretory Antigenic Target 6 (ESAT-6) and the Culture Filtrate Protein 10 (CFP-10), are released into bodily fluids by actively replicating Mtb and can trigger chronic human inflammatory mechanisms, both locally and systemically [2,3]. Currently, most of the detection of low-abundance proteins in human bodily fluids still relies on mass identification technologies, including electrophoresis and Mass Spectrometry (MS) which requires separation and pre-purification steps [4]. New nanoscale approaches however are now being developed and tested, focused upon improving and validating rapid, cost-effective, and high-throughput assays to reach better sensitivity, specificity, and more accurate quantification results for active and latent TB identification [5-8]. By utilizing chemico-physical properties of nano porous materials to isolate peptide signatures of diagnostic Mtb antigens and host biomarkers, with cost-effective bench-top Matrix Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI TOF MS) and other high-throughput techniques, the time of rapidly, quantitatively, and cost-effectively, detecting and assessing potential Mtb diagnostic biomarkers is upon us.

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