

THE HARTWELL FOUNDATION

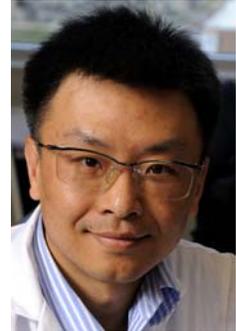
2008 Individual Biomedical Research Award

Review of Proposed Research

Investigator: Samuel Yang, MD
Assistant Professor
Department of Emergency Medicine

Institution: Johns Hopkins University

Proposal: Development of an Electrokinetic-based
Lab Chip for Rapid Diagnosis of Pediatric
Sepsis



Dr. Yang proposes a point-of-care diagnostic device for pediatric sepsis that will analyze a blood sample using a pioneering methodology to rapidly identify and characterize bacterial pathogens within minutes. Sepsis is a life-threatening infection that has spread via the bloodstream. It is an inflammatory condition affecting the entire body, which may involve loss of essential blood pressure (shock), organ failure, and in severe cases imminent death. Among patients with sepsis, systemic bacteremia is the most commonly identifiable and treatable cause. Individuals with a compromised immune system are at most risk for the infection, particularly neonates with an underdeveloped defense against microbes and children fighting off an illness, recovering from surgery, or undergoing cancer treatments. Sepsis is among the top ten causes of death in the United States today. The incidence of sepsis acquired both in and outside of the hospital setting has increased by an average of 8.7% a year in the U.S. for over 20 years, killing over 200,000 Americans each year – more than lung and breast cancer combined. With more than 40,000 cases of severe pediatric sepsis each year, 3% of newborn deaths in the U.S. are attributable to the infection. In part, the severity of the problem may be due indiscriminate use of antibiotics to treat illnesses caused by viruses and not bacteria, which has created strains of bacteria that are antibiotic resistant. From a clinical perspective, prompt recognition of bacteremia is highly desirable since providing early therapy offers the best prognosis for survival. Unfortunately, conventional diagnosis of bacteremia is inherently difficult due to heterogeneity in clinical presentation and unreliable laboratory diagnostics performed only in hospital-based laboratories. Another problem in treating sepsis has been a lack of diagnosis and treatment guidelines for physicians at the bedside. To address this unmet need, Dr. Yang provides a transformative approach to diagnosis of pediatric sepsis at the point-of-care, with a "lab on a chip" that will automatically detect the presence of bacterial DNA in a drop of blood and identify the pathogen. The micro method deploys his patented and validated electrokinetic DNA amplification assay that allows universal bacterial detection and speciation; exploiting novel semiconducting nanomaterials for enhanced throughput and accuracy. If successful, the lab-on-a-chip approach will revolutionize the diagnosis and management of pediatric sepsis and save the lives of numerous children.