

BioMEMS Resource Center – Applications of Microfluidics to Early Diagnosis of Sepsis

Daniel Irimia (deputy director)

BioMEMS Resource Center, Massachusetts General Hospital, Boston, MA, www.BioMEMSrc.org

The P41 BioMEMS Resource Center (BMRC) is developing micro-technologies integrated with living cells for biomedical and clinical applications including cancer diagnostic, infections monitoring, and allergy research. We will illustrate this mission by one example of a technology recently developed as a collaborative project at BMRC, which helps diagnose and monitor sepsis in patients. Sepsis is an abnormal response of the immune system that turns against one's own body, affects ~1 million citizens each year in the US, has 30% mortality rate, and consumes the largest share in Medicare budget (~7% of all expenses). Early diagnosis is critical for reducing mortality from sepsis. To estimate the risk for sepsis more accurately, we focused on neutrophils, the white blood cells that are the earliest responders to tissue injury and microbes. We designed and validated microfluidic technologies that help measure the motility phenotype of neutrophils with higher precision than ever before. To circumvent the challenging logistics of neutrophil isolation in the clinic, we designed these devices to work directly with one droplet of blood. We validated the devices in the clinic and identified a set of phenotype markers capable, 48 hours in advance, of detecting sepsis in patients after major burn injuries.