Decoding Cell Dust: Unlocking Insights for Disease Diagnosis

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The future of biology and medicine is poised at the intersection of engineering, chemistry, nanotechnology, and materials science. Notably, the realms of micro/nano-scale technologies and biomedical engineering have undergone remarkable growth and advancement in the past decade. The integration of cutting-edge technologies at the micro- and nano-scale—termed as "disruptive innovation," presents tremendous opportunities to address unmet needs and overcome key challenges in the fields of biology and medicine. In this talk, Dr. Fatih Inci explores state-of-the-art micro- and nano-scale technologies as precise solutions to improve human health and beyond. In this context, the platforms developed in his lab manipulate biomolecules, cells, cell dusts (extracellular vesicles: EVs), and pathogens in small volumes. Among biomarkers focused on by his team, EVs emerge as crucial carriers of information in cellular communication. Initially perceived as artifacts or cell debris, EVs are now recognized for their essential roles in the development and propagation of various diseases, as well as taking serious roles in disease diagnosis and therapeutics in precision health. However, isolating these nano-sized entities in a size-dependent manner presents a significant challenge in EV research. Conventional methods are often costly, prone to the loss of differently sized EVs or susceptible to contamination, thereby compromising the quality of subsequent investigations. His team’s approach harmonizes microfluidics and biosensing strategies to isolate and identify EVs from clinically relevant specimens. This development establishes a diagnostic and screening scheme for point-of-care settings, enabling individuals to easily self-monitor their health status for precision health applications. Detecting these minuscule yet impactful EV markers represent not only a game-changer in medicine, but also opens up new avenues for precision health and clinical management.