CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP170817

Project Title:
Isolation and in Situ Profiling of Circulating Tumor Cell Subpopulations Using a Hyperuniform Structured Microchip

Award Mechanism:
High Impact/High Risk

Principal Investigator:
Li, Wei

Entity:
Texas Tech University

Lay Summary:

The enumeration and bio-analyses of circulating tumor cells (CTCs) have shown clinical significance in indicating cancer progression and can potentially be used to evaluate the effectiveness of a cancer treatment. It is known that specific CTC subpopulations, rather than the whole, are responsible for cancer metastases. Emerging microfluidic technologies have demonstrated great promise for the complete capture of the whole population of CTCs with high yield and enhanced purity. However, most existing devices simply isolate all CTCs in a blood sample without resolving them into distinct subpopulations, preventing us from ac uiring true insights into the metastatic potential of a specific CTC group. In addition, call capture is only the first step of a pipeline including extensive, often antibody-based post-capture characteri ation. The need for multiple steps, expensive infrastructure and sophisticated processing continue to limit widespread application of captured CTCs. I propose to isolate and in-situ profile heterogeneous CTC subpopulations using a microchip containing uot locally random uot and uot globally homogeneous uot structures. Due to the controlled differences in local flow patterns induced by the hyperuniform structure, cell arrest in different locations on the chip will re uire different adhesive strengths. Further, this adhesive strength is anticipated to correlate with the types and densities of surface markers on the captured CTCs. Modeling of local forces and flows will create a map identifying locations corresponding to subpopulations of CTCs without re uiring post characteri ation. This chip will permit CTCs to be analy ed in-situ to ensure that downstream bio-analyses reflect the true characteristics of these cells and not artifacts created during sample post-processing. The research will allow an improved understanding of cancer progression, metastasis monitoring, and assessment of resistance to therapy in real-time to improve clinical outcomes.