CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP130533

Project Title:
Establishing proteomic-level super-resolution imaging analyses of cancer stem cell phenotypes and behaviors

Award Mechanism:
High Impact/High Risk

Principal Investigator:
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Entity:
Rice University

Lay Summary:

Many cancerous tumors are known to contain small collections of cells that are resistant to therapeutic interventions and uniquely capable of spawning new metastases. These cells are often called cancer initiating cells (CIC) or cancer stem cells (CSC) since they may generate tumors through processes similar to those responsible for normal stem cell self-renewal and differentiation. While these cells have become attractive targets for cancer therapies, many issues surrounding their pathological properties are poorly understood and controversial. These problems are largely derived from the challenges associated with examining the functional properties of these rare cells. Characterizing CSCs ultimately requires the use of cell imaging approaches. Yet, existing microscopy techniques only allow a handful of proteins to be visualized at a time. Thus, important features of CSC biology cannot be examined without improved strategies to image multiple proteins within these cells. This project will develop a new molecular imaging technique that will allow several tens, and potentially hundreds, of cellular proteins to be detected within individual CSCs. Such capabilities will be achieved by generating single-molecule, colorimetric barcodes that can designate the locations of many different CSC pathway proteins simultaneously within a single cell. The utility of this approach will be tested using a cell culture model of CSC-like transitions. Image and computational analyses of the biochemical states of these cells will be employed to delineate how the activities of specific protein networks influence behavioral transitions. Through this demonstration, the proposed work will provide a foundation for new classes of clinical investigations where the molecular phenotypes of CSCs are characterized directly within tumor sections as well as in other clinical settings where CSCs are purified, propagated, and transplanted in order to assess their role in cancer.