JOSEPH F. FOSTER MEMORIAL
CHEMICAL BIOLOGY AND BIOCHEMISTRY SEMINAR

Monday, November 20, 2023
3:30 PM, BRWN 4102

"Altered Cytoskeleton Network and Lipid Metabolism in Hypoxic Cancer Cells Revealed by Chemical Imaging"

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Abstract:

Cancer cells in a solid tumor are adapted to the hypoxia microenvironment which is raised by the disruption of the vasculature. The lack of oxygen leads to cell signaling and metabolic changes that cause resistance to treatment and an increase in metastasis. To discover new targets for the effective removal of hypoxia-adaptive cancer cells, it is critical to understand how cancer cells alter metabolism and structure in the hypoxia microenvironment. Few studies have been performed to understand the alteration of microtubule network and lipid metabolism in cancer cells in hypoxia at the single cell level. The microtubule network plays a key role in cell survival and migration. We first applied time-lapse optical microscopy to study the changes in the microtubule network of HeLa cells in hypoxia. Our results show that hypoxia induces the formation of microtubule-rich protrusions. The enhanced protrusion growth is likely promoted by the alleviated GTP level that is regulated by NDPK and mitochondria trafficking to the protrusion. The protrusion formation in hypoxia is also regulated by glycolysis and cell nutrition levels. Furthermore, we applied hyperspectral-stimulated Raman scattering microscopy and studied hypoxia-induced changes in lipid droplet (LD) distribution in various cancer cells. We found that hypoxia induces LD accumulation on the endoplasmic reticulum (ER). This LD redistribution alleviates ER stress and renders cancer cells more resistant to treatment. We explored the favorable pathways for LD synthesis in hypoxia conditions and identified potential targets for effectively removing hypoxia-resistant cancer cells. Raman spectra results also indicate a change of neutral lipid content induced by hypoxia. This study explores hypoxia-induced changes in the cytoskeleton and lipid metabolism of cancer cells. The new insight would lead to better treatment of hypoxia-adaptive cancer cells.

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