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Elevated heme synthesis and uptake underpin intensified oxidative metabolism and tumorigenic functions in non-small cell lung cancer cells

Heme is an essential iron source and metallonutrient for organisms ranging from pathogenic bacteria to humans. Heme is also a versatile signaling molecule regulating diverse molecular and cellular processes. Heme constitutes 95% of functional iron in humans. As a prosthetic group and cofactor, heme is required for the proper functioning of mitochondrial respiratory chain complexes and many proteins and enzymes involved in oxygen metabolism, such as cytochromes. Elevated heme levels and function are characteristic of many lung cancer cell lines. To illuminate heme function underlying lung cancer cell energy generation and tumorigenesis, we systematically measured heme levels and metabolism, oxygen consumption, ATP generation, and the levels of various hemoproteins and proteins regulating mitochondria biogenesis in an array of lung cancer cell lines and their nontumorigenic counterparts. Our data reveal a systemic upregulation of heme levels, heme metabolism, oxygen-utilizing hemoproteins, and proteins involved in mitochondria biogenesis in lung cancer cells. Our results show that a network involving coordinated elevation of heme flux and metabolism and mitochondrial proteins promotes tumorigenic functions of lung cancer cells.

Biography

Li Zhang completed her PhD at UCLA and postdoctoral studies at the MIT Department of Biology. She is the Cecil H. and Ida Green Distinguished Chair in Systems Biology Science at the University of Texas at Dallas. His laboratory has studied heme signaling and function for 20+ years and published many original research articles and a book entitled "Heme Biology: The Secret Life of Heme in Regulating Diverse Biological Processes" on this subject. Professor Zhang's laboratory has also helped unravel the functions of molecular chaperones, oxygen signaling, and the actions of neurotoxins. His recent research interest is to elucidate the metabolic and signaling network coordinating the functions of heme and mitochondria to promote lung tumorigenesis.

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