

Role of Copper on Mitochondrial Function and Metabolism

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Abstract

Copper is essential for life processes like energy metabolism, reactive oxygen species detoxification, iron uptake, and signaling in eukaryotic organisms. Mitochondria gather copper for the assembly of cuproenzymes such as the respiratory complex IV, cytochrome c oxidase, and the antioxidant enzyme superoxide dismutase 1. In this regard, copper plays a role in mitochondrial function and signaling involving bioenergetics, dynamics, and mitophagy, which affect cell fate by means of metabolic reprogramming. In mammals, copper homeostasis is tightly regulated by the liver. However, cellular copper levels are tissue specific. Copper imbalances, either overload or deficiency, have been associated with many diseases, including anemia, neutropenia, and thrombocytopenia, as well as tumor development and cancer aggressivity. Consistently, new pharmacological developments have been addressed to reduce or exacerbate copper levels as potential cancer therapies. This review goes over the copper source, distribution, cellular uptake, and its role in mitochondrial function, metabolic reprogramming, and cancer biology, linking copper metabolism with the field of regenerative medicine and cancer. © Copyright © 2021 Ruiz, Libedinsky and Elorza.

Author keywords

cancer; copper; differentiation; hematopoietic stem cells (HSCs); metabolic reprogramming; mitochondria; proliferation; ROS