Chapter 5

METABOLIC REPROGRAMMING AND MITOCHONDRIAL ACTIVITY IN CANCER CELLS

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Introduction

Cancer is characterised by uncontrolled cell growth. Metabolic demands to sustain fast proliferation should be compelling since aerobic metastasis is that the initial and most ordinarily shared characteristic of cancer. throughout the last decade, the importance of metabolic reprogramming has been at the middle of attention. However, despite all the information gained on cancer biology, the sphere isn't able to reach agreement on the problem of mitochondria: Are broken mitochondria the cause for aerobic metastasis in cancer? Warburg projected the broken mitochondria theory over eighty years ago, the sphere has been testing the speculation equally long (Gaude, 2018, Zhu et al., 2018).

An important advantage of eukaryotic cell evolution is an energy source for cell metabolism, which leads to an energy gain. Beyond bioenergetics, mitochondrial biology has important functions in mitochondrial biogenesis, fission and fusion dynamics, cell death susceptibility, oxidative stress regulation, metabolism and signaling pathways. In cancer, the cells rearrange their metabolism to save energy and affect mitochondrial function by converting from oxidative phosphorylation to aerobic glycolysis (Gaude, 2018, Pustylnikov et al., 2018). More cancer cells also can modulate energy metabolism inside the cancer microenvironment as well as immune cells and induce "metabolic anergy" of anticancer immune response.

The classical approaches to cancer cell mitochondria generally aim to either induce altered energy metabolism or directly affect the functions of mitochondrial antiapoptotic proteins, but many of these approaches have specific properties and carry side effects. Various types of cancer contain somatic mitochondrial DNA (mtDNA) mutations and a specific immune response to mutated mitochondrial proteins has been observed. An attractive alternative way of targeting mitochondria in cancer cells is the induction of an adaptive immune response against mutated mitochondrial proteins (Zhu et al., 2018, Pustylnikov et al., 2018).

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The explanation of the complex structure of the tumor and its microenvironment will help explain the behaviors of cancer cells. The change in the way energy needs are met along with the changing microenvironment clearly reveals that the mechanisms by which cancer cells are influenced should be clarified. Based on this information, although cancer cells have dysfunctional mitochondria, they prefer to use oxidative phosphorylation instead of glycolysis, indicating that they have functional mitochondria. And that the source of these mitochondria are healthy mitochondria that migrate from neighboring cells forming the microenvironment.

Identifying the molecular mechanisms involved in carcinogenesis is an important way to develop new strategies in cancer prevention and treatment. Metabolic reprogramming of cancer cells is seen as a promising approach and mitochondrial activity is considered as a target for cancer therapy in particular.

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