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Foreword

Bioenergetics of cancer ☆

Cancer research has inspired the field of bioenergetics and mitochondrial physiology with the recent discovery of Kreb's cycle intermediates involved in the regulation of cancer genes essential for tumor survival or the discovery of the role of p53 in the assembly of cytochrome c oxidase via SCO2. Innovative strategies of bioenergetic cancer medicine will emanate from this basic knowledge and the first step consists in the understanding of the modalities of cancer cell energy production. How do cancer cells derive their energy from the accessible carbon sources and what are the preferential energy substrates and processing pathways used for tumor growth?

Cancer cell bioenergetics is mainly determined by a complex interplay among cancer genetics, microenvironment and immunity. Molecular studies have provided new evidence for a variable bioenergetic signature of human tumors in contrast with the dogmal Warburg theory. Within tumors, cancer cells can even use lactate via oxidative phosphorylation to produce energy. These studies emphasize the need for tumor bioenergetic profiling prior to apply designated and personalized metabolic medicine.

In this special issue of BBA Bioenergetics on "Cancer Bioenergetics" we regrouped 25 articles on tumor bioenergetics and putative metabolic anti-proliferative strategies. We present first the particularities of cancer energetics and we discuss some key regulatory mechanisms of tumor catabolism and anabolism. Such mechanisms include for instance the post-transcriptional modification of the mitochondrial F_1F_0-ATP synthase, or the activation of ANT2 and of UCP2 during carcinogenesis. We explain how the bioinformatics modeling of cancer energy production could allow to identify the controlling steps of ATP production. Besides bioenergetic profiling, we present the interaction between cancer energy production and intracellular signaling associated with carcinogenesis. For instance, we explain the role of NOX1 in ROS-signaling and tumor growth or the importance of mitochondrial proteins HtrA2 and HINT2 in the (de) regulation of apoptosis. We further examined the role of mutations in mitochondrial DNA on the susceptibility to cancer. Conversely, we considered the impact of cancer epigenomic and genomic changes on mitochondrial bioenergetics. The last part of this special issue concerns the interaction between bioactive food components and cancer energetics as well as the design of innovative metabolic approaches for cancer-killing.

To conclude, these are exciting times in the field of tumor bioenergetics and this special issue reflects the recent advances in basic science that will support the development of anti-cancer bioenergetic medicine.

Rodrigue Rossignol is a research scientist hired by the French National Institute for Science and Medical Research (INSERM). He performed doctoral studies in Bordeaux and a postdoc at the University of Oregon (Rod Capaldi group). Dr. Rossignol is a member of the directing committee of the Laboratory of Rare Diseases, Metabolics and Genetics (MRGM) in Bordeaux at the University of Bordeaux Segalen and Bordeaux Hospital. His fundamental and biomedical research is focused on the study of energy metabolism in humans, with a particular emphasis on the regulation of oxidative phosphorylation and mitochondrial physiology. This led him to investigate the mechanisms of mitochondrial bioenergetic and morphodynamic dysfunction in metabolic diseases as diverse as pure mitochondrial neuromuscular disorders, common neurodegenerative diseases and cancer. Dr. Rossignol has published 50 articles in the field of cellular bioenergetics and co-chairs the International Society of Mitochondrial Physiology (http://www.mitophysiology.org/). He is section editor of the Organelles In Focus series at the international Journal of Biochemistry and Cell Biology (IJBCB).

Rodrigue Rossignol
Laboratory of Rare Diseases, Metabolics and Genetics (MRGM), University Bordeaux Segalen 146 rue Léo Saignat, 33076 Bordeaux cedex, France
Tel.: +33 5 57574781; fax: +33 5 57571703.
E-mail address: rossig@u-bordeaux2.fr.

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