

Experientia Supplementum

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Mario D. Cordero • Benoit Viollet
Editors

AMP-activated Protein Kinase

 Springer

Editors

Mario D. Cordero
Oral Medicine Department
Universidad de Sevilla
Sevilla, Spain

Benoit Viollet
INSERM U1016 Institut Cochin
CNRS UMR 8104
Université Paris Descartes
Paris, France

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Preface

The survival of all organisms depends on the dynamic control of energy metabolism and the regulation of a plethora of biochemical and molecular processes. The availability or nonavailability of the major cellular energy resource adenosine triphosphate (ATP) determines whether cells may grow and divide or starve and die. Intracellular sensors of cellular energy and nutrient status are emerging as key player in the regulation of cell metabolism in health and disease. Among the different signaling hubs characterized in recent years, adenosine monophosphate-activated protein kinase (AMPK) signaling participates in the maintenance of intracellular ATP levels within an appropriate range. By sensing changes in AMP/ATP and ADP/ATP ratios, AMPK coordinates cellular energy balance by switching on catabolic pathways and switching off ATP-consuming processes at both the cellular and whole-body level.

According to the function of AMPK as a master regulator of cell energy levels, it is becoming evident why a dysfunction in the AMPK signaling pathway has been involved directly or indirectly in the derangement of energy metabolism in many diseases. However, caution is required when interpreting these findings showing correlation rather than formal demonstration for a role of AMPK as a driver of diseases. In addition, given the magnitude of AMPK in biomedical research, it is often difficult to decipher whether this pathway may be of significant relevance for clinicians or basic research workers. A better comprehension in the regulation of the signaling pathway but also the knowledge of available methods and models would be extremely useful. Hence, the aim of this book is to describe the state of the art of AMPK signaling and function by the authors who have been actively committed to recent developments of our understanding of how this key heterotrimeric enzyme operates to control metabolism as well as non-metabolic cellular processes at both the cellular and whole-body level.

The content of the book is distributed into five sections: beginning with basic informations about *AMPK in health*, where the principal functions of AMPK are described; then providing insights into the potential role of *AMPK in disease*, where the pathological consequences of AMPK dysfunction are highlighted; this is

followed by the description of the *Pharmacology of AMPK*, a section dealing with an actualized view of the most relevant compounds used to modulate AMPK activity; then turning to *AMPK in nonmammalian systems*, where recent knowledge on AMPK function in yeast, *Drosophila melanogaster*, *Caenorhabditis elegans*, and plants is presented; and finally, in *Methods to study AMPK*, recent genetic, cellular, and molecular experimental tools in AMPK research field are depicted.

The editors and authors hope this first AMPK textbook will be a useful manual and valuable reference for a large scientific audience in biology and medicine. It is our goal to stimulate research, contribute to a better understanding of the different aspects of AMPK signaling and function, and help the generation of new ideas and scientific projects as well as a step toward translational research. Thus, this book serves as a source of information to facilitate the reading of the literature and should pave the way for improvement of pharmacological and therapeutic intervention in diseases, including aging, cancer, neurodegenerative diseases, and pathogen infection.

Seville, Spain
Paris, France

Mario D. Cordero
Benoit Viollet

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