PREFACE

The field of "mitochondriology" has undergone a renaissance in the last 15 years. Compared to the state of the field as recently as 1985, entirely new areas of investigation have emerged, such as the role of mitochondrial function in apoptosis, aging, and mitochondrial dysfunction in human disease. Furthermore, there have been landmark discoveries and tremendous advances in our understanding of basic phenomena, including mitochondrial import, movement, fission, fusion, inheritance, and interactions with the nucleus and other organelles.

Concomitant with these conceptual advances has been the remarkable increase in the types of tools available to study mitochondrial structure and function. In addition to the traditional methods for isolating mitochondria and assaying their biochemical properties, we now have new and powerful ways to visualize, monitor, and perturb mitochondrial function and to assess the genetic consequences of those perturbations.

In 2001, we assembled the first volume in the Methods in Cell Biology series to bring together those methods—both "classic" and modern—that would enable anyone to study this organelle, be it from a biochemical, morphological, or genetic point of view. The popularity of that volume has inspired us to assemble a second edition that would reflect technical advances of the last few years, as well as new or emerging areas of investigation. Not only has the number of chapters grown from 25 to 36, but much of the material presented in the first volume has been revamped. A few chapters have been eliminated. Fourteen chapters are completely new and cover methods for assaying lactate, pyruvate, β-oxidation, TCA cycle intermediates, cardiolipin, iron–sulfur clusters, and the permeability transition. We have also added a new section on measurements of oxidative stress (assays of reactive oxygen species, free radical scavengers, nitric oxide, and protein thiol modification) and new chapters on examining mitochondrial fission/fusion and on measuring mitochondrial movement in living cells—two related emerging "hot" topics.

A noteworthy, and we believe useful, adjunct to the methods are the appendices, which bring together fundamental information regarding mitochondria that are not found in any single source. These include lists of every known or suspected mitochondrial protein (with approximately 50% more entries in this edition compared to the last), maps of mitochondrial genomes from several commonly-used organisms, and information on agents that perturb respiratory function. Reflecting the boom in "omics," a new appendix has been added describing microarray and proteomic analyses of alterations in mitochondrial function under various conditions.

We dedicate this volume to Giuseppe Attardi, a pioneer in the field of mitochondria in general and mammalian mitochondrial genetics in particular. Among his many notable achievements are the elucidation of the transcription of the human mitochondrial genome and the development of mammalian ρ^0 cells and cybrids. Giuseppe is an inspiration to us all.

Liza A. Pon
Eric A. Schon