

Preface

Mitochondria and chloroplasts are eukaryotic organelles that maintain their own genomes. The products of these genomes work in concert with those of the nuclear genome to ensure proper organelle metabolism and biogenesis. The inspiration for this book was to explore the forces that have shaped organelle genomes and the expression of their genes since their divergence from bacterial ancestors in the distant evolutionary past.

In the opening part, the evolutionary origins of these organelles and their diversification throughout Eukarya are explored. In Part II, we take a closer look at organelle genomes and gene contents and explore a critical process in organelle evolution: loss of organelle genes and the loss of functional plastids and mitochondria. Part III explores what drives this gene loss and genome reduction, specifically the role of mutational processes and transfer of organelle-encoded information into the nucleus.

Once genetic information has switched organelles, how does it get back to the compartment where it performs its function? Part IV looks both at the mechanisms for getting nucleus-encoded organelle proteins back to where they do their jobs, as well as getting a feel for what proteins ultimately are located in an organelle – looking specifically at plastids.

In the final three parts we look at transcription and its regulation (Part V), RNA processing (Part VI), and translation and the genetic code (Part VII). Organelles are microcosms of genome evolution, and some bizarre and unexpected means of gene expression were first identified in organelle genomes. Two such features are RNA editing and modifications to the universal genetic code. Both of these topics are highlighted here.

Two overarching themes that we looked to highlight in this book are current techniques used to study organelle genetics and an evolutionary perspective on how and why organelle genomes evolve as they do. As organelle dysfunction plays essential roles in a variety of cellular processes and is an important factor in many diseases, we hope that this book, rather than simply serving as a review of a small

portion of the vast topic of organelle genetics, might also inspire researchers to consider evolutionary approaches to understanding cellular function, to appreciate the complexity of organelle gene expression, and hopefully to further explore the ideas presented here.

I would like to thank the many talented authors who have contributed their time and expertise to this volume. I would also like to thank external reviewers who gave comments on manuscript drafts and the editors at Springer Publishing for suggesting the idea for this volume and for asking me to participate.

Welcome to the world of organelle genetics!

Sackville, Canada

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Organelle Genetics

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