Preface

Cytoplasmic genes are an essential part of the total genetic endowment of all eukaryotic cells. Their existence was first described in the early 1900's, and their association with cytoplasmic organelles was clearly perceived at that time. It is only now, some sixty years later, that experimental systems have been developed with which to pursue the relationships between cytoplasmic genes, cytoplasmic DNA's, and cytoplasmic organelles.

We are still on the threshold of knowledge about cytoplasmic genes. This very lack of knowledge presages a fruitful future, for it indicates a crucial area of ignorance in our understanding of cellular and molecular biology. Present evidence suggests that cytoplasmic genes are centrally concerned with organelle function and membrane specificity, two areas of outstanding importance for the understanding of normality and of disease.

The principal aim of this book is to apply the concepts and methods of cytoplasmic genetics to the problems of cell and molecular biology to which they can uniquely contribute. I have tried to show geneticists the many attractive problems in this area awaiting their attention; I have tried to show cell biologists and biochemists the usefulness of cytoplasmic genetic analysis in their endeavors; but above all, I have tried to delineate for the student the potential power of an integrated experimental approach using cytoplasmic genes together with the

more conventional tools of biochemistry and electron microscopy in the investigation of organelle biogenesis.

It is now clearer than ever that in the analysis of organelle biogenesis and regulation investigators need the incisive analytical tool that mutations provide. The genetic control of organelle formation and function is turning out to involve a tightly intermeshed network of nuclear and organelle gene products and signals, the complexity of which is just beginning to be revealed. In this circumstance, the availability of genetically mapped and biochemically defined cytoplasmic mutants may be expected to contribute enormously to the dissection of the network of biogenesis, even more than mutants are contributing, for example, to the analysis of phage morphogenesis.

Furthermore, the possibility remains open that further classes of cytoplasmic genes may exist, beyond those in chloroplasts and mitochondria, on DNA's associated with other cytoplasmic organelles, structures, or membrane systems. Indeed, if such DNA's do exist, mutations may provide a more powerful means for their identification than the direct physical isolation of the DNA's themselves.

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