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Edited by

Robert A. LaRossa

DuPont Co., Wilmington, DE

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Preface

The biological emission of light has fascinated humankind for millennia; who is not enchanted by the flashing of fireflies during summer's evenings? Their collection by children in the area surrounding Baltimore, Maryland in the middle of this century for the purpose of biochemical isolation and characterization of light producing proteins and cofactors may constitute the initiation of serious, quantitative studies of this phenomenon. The biochemistry of light production is certainly well-understood today. In bacterial systems it is coupled to the reducing and energy states of the cell, whereas in eukaryotic systems it is dependent upon the availability of ATP. These differences are reflected in the unrelated substrate requirements and structures of eukaryotic and prokaryotic luciferases. These biochemical studies have been aided by the cloning of luciferase-encoding structural genes, the structural genes for cofactor generation, and genes encoding proteins that interact with these light-producing enzymes. These genes also provide starting materials for a wide range of applications that are the subject of this volume.

Many of these advances have earlier been catalogued in two volumes of the *Methods in Enzymology* series. It is thus necessary to provide a rationale for the publication of *Bioluminescence Methods and Protocols*. The format of the *Methods in Molecular Biology* series differs significantly from that of the above-mentioned, classic compilation. It is my belief that the Notes sections of each chapter in this volume will make the methods far easier to exploit in other experimentalists' laboratories by alerting researchers to potential pitfalls and by detailing how they may be adapted for use in related studies.

The choice of contributed material represents the current status of luminescent assays; they are used in fundamental biochemical and microbiological research, analytical biochemistry, basic and molecular toxicology, medicine, and environmental biotechnology. It is my belief that such broad applications provide both an intellectual challenge and great opportunity. By sampling representative applications from such a smorgasbord, the researcher will be encouraged to investigate unexplored territory or to adapt established technologies to their purpose. In either case I hope that this collection will prove a practical, user-friendly reference, one that will lower the "activation energy,"

and thus foster the use of bioluminescent methods and protocols by a broader segment of the scientific community.

Bioluminescence research integrates genetic, biochemical, molecular, biological, and metabolic concepts; the training provided by my mentors, Dieter Söll, Dale Kaiser, Brooks Low, and Phil Hartman, was invaluable in my entry into this arena. My studies have benefited from the collaboration and support of several people. They include Dana Smulski, Tina Van Dyk, Will Majarian, Roz Young, Dave Elsemore, Tim Reed, Mary Jane Reeve, Tricia Watson, Jim Romesser, Prasad Dhurjati, Sameer Rupani, Man Bock Gu, Konstanin Konstantinov, Amy Vollmer, and Shimshom Belkin. I am also grateful to the support of the bioluminescence community; among others, Pete Greenberg, Rheinhardt Rosson, Anne Summers, Moni Ulitzer, Anthony Bulich, Ted Meighen, and Ken Nealson have made me feel most welcome. The contributors are to be thanked for providing manuscripts that are complete, interesting, and conforming to the standards of the *Methods in Molecular Biology* series. I am most grateful to John Walker for providing me with the opportunity to edit this volume. Both he and the staff of Humana Press have given sound guidance, forthright support, and the needed flexibility to bring this project to fruition. I am most appreciative of their help.

For 17 years I have been privileged to work within Central Research and Development at DuPont. The multidisciplinary atmosphere of this section, which defines the crossroads of a large corporation with only indirect accountability to its profit centers, has been most stimulating. I am thankful to DuPont, my colleagues, and family for allowing me to follow my dreams.

Robert A. LaRossa

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