

# Preface

Studies of biotic interactions of algae that involve chemical defenses or signals are currently vibrant, active components of both marine ecological and phycological research. This field is rapidly growing, not only by delving deeper into relatively well-known aspects such as secondary metabolite defenses of tropical and temperate macroalgae to herbivores but also by broadening such work into new habitats and by expanding the field to include many other aspects of the chemical interactions of algae with other organisms or with their environments.

This book has attempted to span the breadth of algal chemical ecology from the perspective of basic ecology. To keep it of manageable length, its scope is restricted primarily to ecological aspects of the field and in doing so, it is unfortunate that a great deal of excellent work in applied areas of algal chemical ecology could not be included. Likewise, algal natural products chemistry is not emphasized in most chapters but the book begins with an introduction to the chemistry of algal defenses that is intended as a primer on natural products chemistry for algal ecologists. In addition, although intended to be broad, it could not be so comprehensively and consequently each author was asked to highlight new areas of research and simply refer a reader to previously published reviews where appropriate. Nevertheless, regardless of previous reviews, the authors were asked to go into depth in one or more areas that they felt would be particularly valuable to illustrate important concepts that could be incorporated into undergraduate- or graduate-level ecology or phycology courses.

As noted, Chap. 1 was intended to help algal ecologists understand the chemistry underlying chemical ecological studies. Chapters 2–5 focus on defenses of macroalgae, primarily though not exclusively on their defenses against herbivores. These chapters are divided by geography and habitat with the relatively well-studied tropical and temperate marine communities the focus of the first two and the relatively understudied freshwater and polar marine communities the focus of the latter two. Chapters 6 and 7 unify these by collectively examining new ways of looking at macroalgal chemical defenses as well as the utility of macroalgae across latitudes and habitats as models for testing and expanding broad ecological theories. Chapter 8 follows with a focused examination of a relatively new area of macroalgal chemical ecology, the multiple potential roles of dimethylsulfoniopropionate in algal ecology and physiology.

The chemical ecology of phytoplankton has been a major new focus of research over the past decade. Chapter 9 was originally intended as a detailed review of this field but unfortunately, for reasons both understandable and unforeseeable, the author was unable to complete it. Fortunately, most individual aspects of the field have been reviewed in a number of recent publications and I am very grateful to Professor Pohnert, himself the author of several of those reviews, for preparing this relatively short chapter that reviews these reviews and that can serve the reader as a unifying introduction into this literature.

Chapters 10–12 all deal with exciting and relatively new areas of study in both macroalgal and microalgal chemical ecology. Chapter 10 examines how herbivores “fight back” in adaptive response to the chemical defenses elaborated by their algal prey. Chapter 11 reviews the relatively few (and comparatively recent) studies of algal secondary metabolite defenses against biofoulers and pathogens that have been conducted with ecologically relevant methodology while Chap. 12 examines the relatively new field studying oxidative burst responses of algae as a defense against these same threats.

Finally, Chaps. 13 and 14 both review other areas of macroalgal and microalgal chemical ecology that have been studied to some extent for a number of years but which are both active areas of current research. Chapter 13 focuses on the multiple ways in which algae utilize defensive compounds to limit damage from ultraviolet radiation. Chapter 14 reviews studies of the behavioral sensory ecology of algae, which is very much understudied in comparison to such work on terrestrial and aquatic animals.

With the exception of Chap. 9, all of the chapters were peer-reviewed and the thoughtful assistance of all the peer-reviewers is deeply appreciated. In almost every case there were at least two anonymous reviews of each chapter and I am grateful to Drs. Katrin Iken and Maureen Callow for coordinating the anonymous reviews of Chaps. 4 and 14, respectively. I am also grateful to Dr. James McClintock, Craig Aumack, and in particular to Margaret Amsler for help in editing several of the chapters. In addition, I thank Dr. Christina Eckey for inviting me to take on this project and Dr. Andrea Schlitzberger for a myriad of assistance in seeing it through to completion. In closing, I am sincerely grateful for the continuing financial support of my own work in algal chemical ecology from the Office of Polar Programs at the United States National Science Foundation and also past support from the Mississippi–Alabama Sea Grant Consortium.

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