
Preface

The genesis of this book lies in research by the lead editor (BO) on the dispersal and metapopulation biology of the freshwater bryozoan, *Cristatella mucedo*. This research, which entailed routine screening of bryozoan colonies for signs of sexual reproduction, led to startling observations of strange globular sacs tumbling within the capacious body cavity of *C. mucedo* colonies collected from sites in the Thames Valley of southern England. These sacs were clearly not of bryozoan origin, and a determination to resolve their mysterious nature led to collaborative work with Liz Canning. This fruitful collaboration resulted in the recognition that those strange sacs were myxozoans and the subsequent description of a previously unrecognised clade of myxozoans—the Malacosporea. The unanticipated discovery of malacosporeans highlights how at the end of the twentieth century, unrecognised biodiversity remains even in a highly populated, developed country whose fauna and flora are more comprehensively documented than in any other. It also emphasises how unexpected outcomes of both fundamental and practical significance can arise when studying what many would regard as obscure organisms (freshwater bryozoans). Thus, following their serendipitous discovery, malacosporeans have played a central role in confirming the longstanding speculation that myxozoans are an endoparasitic radiation of cnidarians. In addition, the causative agent of a devastating disease of salmonid fish was finally identified, the enigmatic nature of a bizarre worm-like parasite of bryozoans (*Buddenbrockia plumatellae*) was resolved when it was revealed to belong to the Malacosporea, and the loss of primitive features during myxozoan evolution has been revealed (muscles and epithelia are lacking in the highly derived Myxosporea).

As a result of the above developments myxozoans are now of specific interest for understanding evolutionary trajectories of early diverging metazoans. They are also of practical interest as causative agents of fish diseases that threaten wild populations and impact aquaculture and fisheries worldwide. Changing environmental conditions are exacerbating some of these diseases while introductions effected by human activities may contribute to disease spread. It is therefore now timely to synthesise the diverse literature on the biology of myxozoans in the context of understanding them as a radiation of endoparasitic cnidarians with complex life cycles that involve invertebrate and vertebrate hosts. Thus, when the lead editor was contacted by Springer Publishers about producing such a book, she readily accepted.

The ambition to develop an edited volume that incorporates chapters broadly representative of myxozoan research led to the assembly of an editorial team with sufficient multidisciplinary expertise to commission such chapters (and sometimes to contribute as authors to them). The result is the first comprehensive book on myxozoans. Our book provides up-to-date cover of subjects ranging from myxozoan ecology, evolution and developmental biology through to immunology, risk assessment, disease mitigation and predicting the impacts of climate change on disease. We are gratified that nearly all of the myxozoan researchers contacted were keen to contribute and, consequently, our authors are based in academic and government agencies in 13 countries in Europe, North America and Asia. This has enabled us to achieve our original ambition—to provide extensive cover of myxozoan research today and to characterise the functional biology of these endoparasitic cnidarians. The synthesis of knowledge provided by the various chapters in our book will be of fundamental interest to invertebrate zoologists, evolutionary biologists, developmental biologists, ecologists and parasitologists and of practical interest to fisheries and conservation biologists. Our chapters also identify gaps in knowledge which are highlighted as key questions for future research. We hope these questions may inspire the next generation of myxozoan researchers to contribute in new ways.

We are grateful to Stephen Atkinson for designing and putting together our book's lovely frontispiece which illustrates a diversity of myxozoan spore stages. The images are described below as species (where known), spore stage and image credit: *Ariadna* Sitjà-Bobadilla (ASB), Stephen Atkinson (SA), Chris Whipps (CW), Hanna Hartikainen (HH).

Top row: *Enteromyxum leei* myxospores (ASB); aurantiactinomyxon-type actinospore (SA); *Myxobolus notropis* myxospores (SA); *Sphaerospora dicentrarchi* myxospore (ASB)

Second row: *Hoferellus carassii* myxospores (SA); *Ceratomyxa sparusaurati* myxospores (ASB); *Ceratonova gasterostea* myxospore (SA); *Dicauda atherinoidi* myxospore (SA)

Third row: *Sphaeromyxa kenti* myxospores (CW); *Chloromyxum auratum* antonactinomyxon-type actinospore (SA); *Tetracapsuloides bryosalmonae* malacosporos (HH); *Myxobolus cerebralis* triactinomyxon-type actinospore (SA)

Fourth row: tetractinomyxon-type actinospores (SA); *Sphaerospora sparis* myxospore (ASB); *Chloromyxum auratum* myxospore (SA); *Myxidium* sp. myxospores (SA)

Fifth row: *Chloromyxum* sp. myxospore (SA); *Myxidium anatum* myxospore (SA); *Kudoa inornata* myxospores (SA); echinactinomyxon-type actinospore (SA)

Bottom row: *Myxobolus insidiosus* myxospores (SA); *Myxobolus* sp. myxospore (CW); *Ceratonova shasta* tetractinomyxon-type actinospore (SA); *Henneguya zschokkei* myxospore (SA)

Each of our chapters received two reviews (one from a contributing author to another book chapter, one from someone with more general expertise in the subject area) and further extensive evaluations by the editors. Such appraisal has helped to improve the quality and cover of our chapters. We are therefore grateful to the following who have variously acted as reviewers for one or more of our chapters: Pilar Alvarez-Pellitero, Stephen Atkinson, Vickie Blazer, Isaure de Buron, Allen Collins, Arik Diamant, Iva Dyková, Daphne Fautin, Ivan Fiala, Stephen Feist, Bart Gorglione, Sascha Hallett, Peter Hammond, Ashlie Hartigan, Hanna Hartikainen, Jason Holland, Jukka Jokela, Simon Jones, Egil Karlsbakk, Thomas Lang, Tim Littlewood, Christine Moffitt, David Morris, Oswaldo Palenzuela, Ed Peeler, Russell Perry, Maria Santos, Andrew Shinn, Ariadna Sitjà-Bobadilla, Andrea Waeschenbach, Thomas Wahli, Chris Whipps, Geert Wiegertjes and Hiroshi Yokoyama.

We are deeply indebted to all of our authors whose contributions have made our book possible and who bore with us during the various stages of chapter development. They responded to our numerous editorial requests in a helpful and accommodating fashion even when they did not have the overview of all of the developing chapters that was available to us. We hope that they will be happy with the outcome and gratified by the synergism arising from their collective contributions.

Finally, we thank Annette Schneider from Springer Publishers who originally contacted the lead editor regarding her multifaceted research on bryozoans and myxozoans and to enquire about publishing a book that would integrate the evolution of highly specific body-plans, life cycles and host-parasite interactions. The resulting book is clearly broader than this and we are grateful to Annette for encouraging us to drive its subsequent development forwards. We also thank Andrea Schlitzberger who later took over as the Springer editor and has provided valuable feedback especially on production matters.

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