

Preface

The importance of combating infectious diseases has received international attention, providing the opportunity for a multidisciplinary approach that combines medicine with other scientific and technological capabilities, notably information technology, nanotechnology, and biotechnology. In fact, it has been predicted that the future will bring a merging of these technologies with the cognitive and behavioral sciences—major forces that have the potential to balance the world's inequities. The scientific community and world leaders must work together to use knowledge and its applications to improve the condition of the planet. The connection between infectious diseases and the oceans provides a paradigm for this perspective.

A stark global context indisputably frames all human health issues in the twenty-first century: the world wide movement of people and goods. Throughout the past half century, international travel has skyrocketed; there are more than 500 million international arrivals per year. The greatest increase has taken place since the mid-1990s. The world has become integrated and global; consequently, the notion that it is possible to successfully eradicate a disease from the face of the planet has become simplistic. Infectious disease is a moving target and climate shifts will affect any disease that has an environmentally sensitive stage or vector. Recognizing signals from climate models and incorporating them into health measures can provide new opportunities for proactive—rather than reactive—approaches to public health. Thus, careful attention to the role of the oceans in human health can offer new avenues of research that will provide new means of predicting and preventing those diseases that are rooted in the environment.

In this volume, pathogens in the sea are reviewed by Colin Munn, who provides a broader perspective for the topic of pathogenic microorganisms associated with the world oceans. The wide diversity of microbial pathogens, their ecology, and the methodologies for their detection are described by Janelle Thompson and her colleagues, while Albert Bosch and colleagues devote their chapter to a review of human viruses, a notoriously difficult group of microorganisms to track in the marine environment.

The ubiquitous vibrios are discussed by several authors and from many aspects. The topic is reviewed in detail by Carla Pruzzo and colleagues, while in-depth discussions of *Vibrio vulnificus* and *Vibrio parahaemolyticus* are provided by James Oliver and by Balakrish Nair and colleagues, respectively. The latter chapter also explores associations with higher organisms as well as seafood safety issues. A global perspective for members of this group, including climate, seasonality, sea surface temperatures, and plankton population cycles, is addressed by Rita Colwell. Understanding causation of global cholera epidemics requires a panoramic view of the ecology of vibrios in the sea, as discussed in Chapter 12. Karunasagar and Karunasagar focus on the importance of the viable but nonculturable (dormant) stage of existence to pathogenicity. Interestingly, VBNC also plays a role in geographic distribution.

Another group of highly significant bacterial human pathogens, often not considered in the marine context, are the Gram-positive bacteria; this group is reviewed in detail by Pietro Canepari and co-workers.

Regardless of the nature and the source of the pathogens, their eventual impact on their target population will depend, to a large extent, upon a combination of chemical, physical, and biotic factors. The survival of bacterial and viral pathogens is addressed by Lester Sinton and by Charles Gerba, respectively, and at the molecular level by Yael Rozen and Shimshon Belkin. The epidemiological and engineering aspects of these factors are described by Monique Pommepey, and the economic consequences of subsequent human infections are analyzed by Hillel Shuval.

Bacteria and viruses are not the only pathogens in the marine environment. The oceans also harbor a wide variety and diversity of protists, which are only beginning to be understood as a significant component of marine ecosystems. Ronald Fayer and James Trout provide a very useful introduction to the zoonotic protists that enter this environment in feces from domesticated animals, wildlife, and/or humans. Algal blooms, another newly emerging source of harm to humans and animals, are discussed by Jan Landsberg and colleagues.

While this book was originally intended to discuss human pathogens only, we have come to realize that a more complete coverage of the topic should include pathogens of other organisms as well. Three groups of marine organisms of significance to marine ecology and of human economic interest were selected: fish, corals, and aquacultured crustaceans. The diseases of these three groups are respectively reviewed by Brian Austin, Eugene Rosenberg and Yael Barash, and by Jeffery Lotz and colleagues. These three concluding chapters serve to re-emphasize the many levels at which the well-being of the natural environment is intertwined with human health and human interests.

The distinguished authors of the chapters of this volume bring their insight and experience to bear on the issue of the health of the world oceans, but more importantly to the reliance of human health on understanding the potential of pathogens, both autochthonous and pollution-introduced, in the marine environment. The blue planet we inhabit as human custodians of its environment, has three-fourths of its surface area covered by oceans. If we do not understand the microbial ecology of this vast expanse, especially with regard to pathogens, both identified and as yet unrecognized, we will play a deadly game of public health roulette.

We thank our co-authors for the generosity of their time and knowledge and especially for their patience. All have been rewarded, I hope, by the usefulness and timeliness of this book.

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