

# Marine Toxins and Venoms

Handbook of  
Natural Toxins  
volume 3

edited by  
Anthony T. Tu



# Handbook of NATURAL TOXINS

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Volume 3

MARINE TOXINS AND VENOMS

*Edited by*

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## Preface to the Handbook

Natural toxins are unique toxins which possess some common properties, whether they are obtained from plants, microorganisms, or animals. One common characteristic is that they exert a pronounced effect on the metabolism and biological functions of the intoxicated animals with just a minute quantity. Since ancient times human beings have pondered the physiological effects of various toxins and venoms. How do these natural poisons work? Despite possessing some common nature, each toxin, however, has its unique mode of action and its own characteristic structure.

Drugs are compounds that have specific beneficial effects with a minute quantity. Usually, natural toxins also have very specific effects. Therefore, it is not surprising that many natural toxins are potentially good drugs.

Heretofore, the study of each field of toxins has been taking an independent pathway. Scientists in a specific toxin field are often unaware of the activity in other toxin fields. It is thus desirable to have a primary source of information on all natural toxins so that scientists in a specific discipline of toxin research can easily obtain useful information from other toxin researchers.

This five-volume handbook of toxins will include the following volumes:

1. *Plant and Fungal Toxins*
2. *Insect Poisons, Allergens, and Other Invertebrate Venoms*
3. *Marine Toxins and Venoms*
4. *Bacterial Toxins*
5. *Reptile and Amphibian Venoms*

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Anthony T. Tu

## Preface to Volume 3

Approximately 71% of the earth's surface is covered by water. The seas are full of living organisms, perhaps containing more flora and fauna than all plants and animals combined on land. Human efforts are directed at seeking scientific truths in the far reaches of outer space, yet we are still far from fully understanding life under the seas. Our knowledge of natural poisons is still fragmental even for the most studied terrestrial animals and plants, and our knowledge of marine toxins and venoms is even more limited.

Nevertheless, considerable progress has been made in this field in the past decade or so due to the constant endeavor of many tireless scientists. It is timely to assemble scientific data into one volume to summarize the scientific efforts of scientists who work with marine toxins. This book is composed of four parts. The first part is a brief bird's eye view of the biology of toxic marine organisms. The second part covers marine toxins and is comprised of eleven chapters. The third deals with marine venoms. Some animals possess venom apparatus from which poisons are delivered. The last section describes the clinical aspects of marine poisoning. Altogether nineteen chapters are assembled into this volume of *Handbook of Natural Toxins*.

Since Volumes 1 and 2 of *Handbook of Natural Toxins* were published, reaction from the scientific community has been enthusiastic. Therefore, a newly revised edition of Volume 1, *Plant and Fungal Toxins*, will be published in the future. It is hoped that Volume 3, *Marine Toxins and Venoms*, will stimulate the interest of young and new scientists who would like to study marine toxic compounds.

Anthony T. Tu

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# 1

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## I. INTRODUCTION

Biotoxicology, also referred to as toxinology, is the science of plant and animal poisons and is concerned with a vast number of toxic chemical substances, most of which remain to be characterized. Biotoxins are of two major types: phytotoxins, or plant poisons, and zootoxins, or animal poisons. Biotoxins can be classified in a variety of ways, according to one's approach to the subject. However, for the purpose of this chapter, only a few representative species of toxic marine organisms have been selected.

Marine zootoxins can be subdivided into those that are poisonous to eat, the oral poisons, and those that are administered by means of a venom apparatus, the parenteral poisons. The administration of venoms entails mechanical trauma, whereas other types of poisons do not. The term "poisonous" may be used in the generic sense, referring to both oral and parenteral poisons, but it is more commonly used in the specific sense to designate oral poisons. Thus, all venoms are poisons, but not all poisons are venoms. Oral marine biotoxins are generally thought to be small molecular substances, whereas most venoms are believed to be large molecular substances, proteins, or in close association with proteins. A third general type of marine biotoxin found in soft corals, flatworms, nemerteans, fish, and other organisms is an endogenous poison produced by glands but not accompanied by a venom-purveying structure. The biotoxin is generally released into the adjacent environment by means of pores in a manner somewhat comparable to the action of sweat glands. These endogenous poisons are referred to as crinotoxins. For the most part, little is known about the chemical or pharmacological nature of these poisons.

Little is known of the biologic significance of marine biotoxins. However, they appear to serve as defensive or offensive mechanisms in food procurement, or they may be accidentally contracted in the food web of the organism. This is an area of ecological research that as yet has received only a modest amount of attention.

Biotoxins offer a spectrum of new or little-known molecular structures that the synthetic chemist may ultimately find possible to synthesize and