
Toxinology

Editor-in-Chief

P. Gopalakrishnakone

In recent years, the field of toxinology has expanded substantially. On the one hand it studies venomous animals, plants and micro organisms in detail to understand their mode of action on targets. While on the other, it explores the biochemical composition, genomics and proteomics of toxins and venoms to understand their three interaction with life forms (especially humans), development of antidotes and exploring their pharmacological potential. Therefore, toxinology has deep linkages with biochemistry, molecular biology, anatomy and pharmacology. In addition, there is a fast-developing applied subfield, clinical toxinology, which deals with understanding and managing medical effects of toxins on human body. Given the huge impact of toxin-based deaths globally, and the potential of venom in generation of drugs for so-far incurable diseases (for example, diabetes, chronic pain), the continued research and growth of the field is imminent. This has led to the growth of research in the area and the consequent scholarly output by way of publications in journals and books. Despite this ever-growing body of literature within biomedical sciences, there is still no all-inclusive reference work available that collects all of the important biochemical, biomedical and clinical insights relating to toxinology.

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Editor-in-Chief

Abul Faiz • Ravindra Fernando
Christeine Ariarane Gnanathan
Abdulrazaq Garba Habib
Chen-Chang Yang
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Clinical Toxicology in Asia Pacific and Africa

With 170 Figures and 43 Tables

 Springer Reference

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Series Preface

The term TOXIN is derived from the Greek word *Toeikov* and is defined as a substance derived from tissues of a plant, animal, or microorganism that has a deleterious effect on other living organisms. Studying their detailed structure, function, and mechanism of action as well as finding an antidote to these toxins is the field of TOXINOLOGY, and the scientists are called TOXINOLOGISTS.

In recent years, the field of toxinology has expanded substantially. On the one hand, it studies venomous animals, plants, and microorganisms in detail to understand their habitat, distribution, identification, as well as mode of action on targets, while on the other, it explores the biochemical composition, genomics, and proteomics of toxins and venoms to understand their interaction with life forms (especially humans), the development of antidotes, and their pharmacological potential for drug discovery. Therefore, toxinology has deep linkages with biochemistry, molecular biology, anatomy, pharmacology, etc. In addition, there is a fast-developing applied subfield, clinical toxinology, which deals with understanding and managing medical effects of venoms and toxins on the human body following envenomations. Given the huge impact of envenomation-based deaths globally and the potential of venom in the generation of drugs for debilitating diseases (e.g., diabetes, chronic pain, and cancer), the continued research and growth of the field is imminent.

Springer has taken the bold initiative of producing this series, which is not an easy target of producing about 11 volumes, namely, biological toxins and bioterrorism, clinical toxinology, scorpion venoms, spider venoms, snake venoms, marine and freshwater toxins, toxins and drug discovery, venom genomics and proteomics, evolution of venomous animals and their toxins, plant toxins, and microbial toxins.

Singapore

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I would like to sincerely thank the section editors of this volume, Abul Faiz, Ravindra Fernando, Christine Ariarane Gnanathan, Abdulrazaq Garba Habib, and Chen-Chang Yang, for the invaluable contribution of their expertise and time and the authors who obliged with my request and provided a comprehensive review on the topics.

Springer provided substantial technical and administrative help by many individuals at varying levels, but special mention should go to Mokshika Gaur, Meghna Singh, and Audrey Wong for their tireless effort in bringing these volumes to reality.

Singapore

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Volume Preface

Clinical toxinologic conditions are becoming increasingly frequent, more so than is generally recognized. The conditions comprise of clinical aspects such as the diagnosis, management, and prevention of snakebite envenoming, scorpion sting, mushroom toxins, plant toxins, and other natural toxins. Clinical toxinology also deals with the ecology, epidemiology, regional differences, and varieties of fauna accounting for different envenoming manifestations.

This handbook includes 30 chapters addressing various topics on clinical toxinology such as the epidemiology and management of snakebites in different Asian and African countries, disability following snakebite, effect of snake venoms on hemostasis, socioeconomic aspects of snakebites, therapeutic application of snake venom, scorpion sting in the Middle East, jellyfish sting, etc. These titles are written by experts currently working in the subspecialty, many of whom have first-hand experience in relevant research field. In virtually all the topics, appropriate illustrations are provided to simplify comprehension including tables, figures, pictures of snakes, etc.

A variety of clinical patterns and toxidromes commonly observed in practice are described and depicted. Thus, this handbook will be very useful to students and specialists that work or study expedition and wilderness medicine, traveller's health, tropical and geographic medicine, and health economics, among others.

Snakebite is a major clinical toxinologic issue worldwide, especially in the rural areas of developing countries in tropical and subtropical regions, with an estimate of at least 400,000 envenomings and 20,000–50,000 deaths annually worldwide. The actual figures may be much higher due to under-reporting of the bitten incidents. Therefore, clinical toxinologic issues related to venomous snakebites are heavily covered in this handbook, and various important aspects of snakebites are discussed. For example, in the management of snakebites, the only specific treatment is antivenom; however, antivenom is often unavailable in the rural areas and remote health centers in developing countries. The vast majority of the estimated burden of venomous snakebites is thus derived from South and Southeast Asia, sub-Saharan Africa, and Central and South America. Several chapters in this handbook have addressed the epidemiology and management of venomous snakebites in different Asian and African countries.

Moreover, the use of antivenoms produced by the purification of IgG immunoglobulins from large animals immunized against specific snake venoms is life-saving. Nevertheless, very little has been changed on the way these antivenoms are produced in the last few decades. The advances on the transcriptomic analysis of venom glands from different snake species with a focus on the efforts to develop antivenom sera by DNA immunization and its efficacy in neutralizing the toxic effects elicited by the envenomation from snakebite are also discussed in this handbook.

In this modern era of science and technology, this volume, *Clinical Toxinology in Asia Pacific and Africa*, in the series, *Toxinology*, is designed to keep abreast with new knowledge and experience in toxinology regionally and globally. Toxinologists, researchers, scientists, and experts in this field from various working areas considered it necessary to collect all the aspects of clinical toxinology in a single, handy handbook. This can be used by medical students, postgraduate students, general practitioners, specialists in internal medicine, critical care physicians, emergency physicians, and anesthetists worldwide.

We are certain that this publication in the field of toxinology will advance knowledge and understanding of clinical toxicological issues at different levels and that it will entice actions through cognitive, curative, and preventive measures aimed at making improvements in this discipline worldwide.

March 2015

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Prof. Gopalakrishnakone has more than 160 international publications, 4 books, about 350 conference presentations, and 10 patent applications.

He has been an active member of the International Society on Toxinology (IST) for 30 years and was president from 2008 to 2012. He is also the founder president of its Asia Pacific Section, a council member, as well as an editorial board member of *Toxicon*, the society's official journal.

His research awards include the Outstanding University Researcher Award from the National University of Singapore (1998); Ministerial Citation, NSTB Year 2000 Award in Singapore; and the Research Excellence Award from the Faculty of Medicine at NUS (2003).

His awards in teaching include Faculty Teaching Excellence Award 2003/2004 and NUS Teaching Excellence Award 2003/2004. Prof. Gopalakrishnakone also received the Annual Teaching Excellence Award in 2010 at both university and faculty levels.

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World Health Organization Malaria Treatment Guideline Committee, the National Steering Committee for the elimination of kala-azar, Bangladesh, and Regional Technical Advisor for malaria, SEARO WHO. Currently, he is the president of both Bangladesh Association for Advancement of Tropical Medicine (BAATM) and Toxicology Society of Bangladesh (TSB). He is member of the Board of Drugs for Neglected Diseases Initiative (DNDi); International Advisory Board, *Davidson's Principles and Practice of Medicine*; and editorial board, *Asian Neurology* and *Journal of Bangladesh Society of Medicine*. He has been involved as principal investigator in key clinical studies on malaria. He has the credit of publication of several hundred articles in peer-reviewed journals.



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Professor Fernando was the founder secretary general of the Indo-Pacific Association of Law, Medicine and Science and a past president of the Ceylon College of Physicians, Sri Lanka Medical Association, and the College of Forensic Pathologists of Sri Lanka and Asia-Pacific Association of Medical Toxicology.

He was a member of the World Health Organization's Expert Advisory Panel for Vector Biology and Control, and a member of the Scientific Committee on Pesticides of the International Commission on Occupational Health.

Professor Fernando was the founder head of the National Poisons Information Centre, in Sri Lanka. He has also served as the chairman of the National Dangerous Drugs Control Board.

He is an international editor, *Medicine, Science and the Law*, the official journal of the British Academy of Forensic Sciences, and *Journal of Forensic Medicine and Toxicology*, and the editor-in-chief of the *International Journal of Prevention and Treatment of Substance Use Disorders*, published by the Colombo Plan.



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In her capacity as a medical teacher and a medical specialist, she has contributed to undergraduate and postgraduate teaching, development of the medical curriculum, and for continuing medical education of doctors and nurses. She has been

instrumental in developing the Herpetarium and Snake Venom Research Laboratory in the Department of Clinical Medicine, Faculty of Medicine, at the University of Colombo. Professor Gnanathan has contributed to venom research and clinical trials on antivenom and is working on an indigenous anti-snake-venom serum. Awarded the Master of Philosophy degree, her thesis, “A National, Hospital Based Survey of Snakes (Venomous and Non Venomous) Responsible for Human Bites in Sri Lanka – A Clinico-Epidemiological Study,” examined clinico-epidemiological surveys of identified snakebites in Sri Lanka. She has published about 50 scientific papers in peer-reviewed international medical journals, authored 2 books for her credit, and is recipient of several research awards and prizes. Snakebites, toxicology, and internal medicine are her main research interests.



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Also, he is the former dean, Faculty of Medicine, and the current provost of the College of Health Sciences, Bayero University Kano, and consultant in infectious and tropical diseases at Aminu Kano Teaching Hospital in Kano, Nigeria.

Professor Habib trained and worked at university hospitals in Nigeria, Saudi Arabia, England, and Singapore. His areas of interest include community-acquired infections, emerging infections, human immunodeficiency virus (HIV) infections, immunology, tropical diseases, and snakebites. He participated in the initial characterization of a new emerging infection CoV SARS in Singapore (2003). He served as director medical services (2005–2007) and subsequently as a consultant to the Institute of Human Virology, Nigeria (an affiliate of Institute of Human Virology University of Maryland, USA), where they provided care to over one-third of HIV-infected patients in the country.

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He has over 100 publications on global health and is a recipient of several awards and prizes including the third prize of “World Oxoid infection control team of the year award in 2007” (Basingstoke, UK, corecipient), Singapore Prime Minister’s medal and certificate of appreciation and courage fund medal for valor and selfless dedication during the SARS epidemic in 2003, and Ayo-Iyun Prize for best result in WACP examinations (winner).



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