EDITORIAL

Peptide Toxins in the Defense Against Human Disease

Toxins isolated from living creatures have captured the attention and imagination of researchers for generations due to their potent activities. This interest has spawned fields of research that include neutralisation of the toxic effects and the exploitation of toxin properties for our own purposes.

Although perhaps not traditionally thought of as toxins, peptide toxins are found expansively throughout nature and possess a variety of 'toxic' properties involved in prey capture and defense. When considering toxic molecules from living creatures, many people immediately envisage the rich source of peptide toxins that constitute the venoms of spiders and snakes. However, peptide toxins are also available from many relatively 'innocuous' sources such as snails and plants. This series of articles provides a sample of the research on peptide toxins currently being undertaken in Australia, with particular focus on peptides from cone snails, plants, mammals and frogs.

In their article, Anthony Purcell and Helena Safavi-Hemami discuss the promising potential of cone snail peptide toxins in drug design, despite the stigma associated with their 'toxin' reference. In addition to their significant potential as therapeutics, cone snail peptides have also proved to be valuable pharmacological research tools. Consequently, understanding how they fold and their biosynthetic pathways has also attracted significant research attention. Anthony and Helena highlight recent studies on the folding of conotoxins and the likelihood of co-evolution of folding enzymes for particular toxins.

David Craik, David Wilson and I provide a summary of the emergence of the field of gene-encoded cyclic peptides. These peptides are typically involved in defense mechanisms, but are highly divergent in structure, bioactivity and biosynthetic pathways. The stability conferred by the cyclic backbone has led to several studies aiming to capitalise on this attribute for the development of novel drug leads.

Johan Rosengren highlights a class of cationic peptides known for their potent anti-microbial defense properties, aptly termed defensins. Several of these peptides have the unusual property of maintaining activity in the absence of their usual well-defined three-dimensional structures. The implications for this unusual finding are discussed.

The final article by John Gehman and Marc-Antoine Sani provides an insightful overview of antimicrobial peptides. Numerous peptide toxins display antimicrobial activity, including several discussed in the articles in this series. This particular review highlights the different mechanisms of action and how peptides fit in with 'typical' antibiotics, and concludes with an indication of what the future may hold for antimicrobial peptides.

The diversity of peptide toxins in terms of their bioactivities, structure and biosynthesis will no doubt continue to result in fascinating discoveries. In particular, it will be of great interest to determine if peptide toxins have a beneficial use against human diseases.

Norelle Daly
Queensland Tropical Health Alliance, School of Pharmacy and Molecular Sciences, James Cook University, QLD 4870
norelle.daly@jcu.edu.au

Cover Illustration

Peptide toxins come from a variety of sources including plants, mammals, frogs and fungi. Their bioactivities, biosynthesis and structures vary enormously but several are involved in defense properties and might have potential in drug design. The structures of selected examples are shown. Top panel: crytidin-4 (PDB code 1TV0), right panel: kalata B1 (PDB code 1NB1), bottom panel: AuIB (PDB code 1MXN) and left panel: magainin 2 (PDB code 2MAG). *Image courtesy of David Wilson, Queensland Tropical Health Alliance, James Cook University, Cairns.*

Peptide Toxins

Guest Editor: Norelle Daly

In the next issue...

In December, the Special Technical Feature will be on **Nanotechnology in Therapeutics** - *Guest Editor: Maria Kavallaris*

Australian Biochemist - **Editor** Rebecca Lew, **Editorial Officer** Liana Friedman