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TUNIPEPS - Discovering a new family of hypermodified antimicrobial peptides from marine tunicates and exploring their potential applications

The spread of antimicrobial resistance among human pathogenic bacteria and fungi is a major global and European concern, urgently necessitating the development of novel antibiotics. Another unsolved global healthcare problem is the burden of infections acquired through invasive medical devices. Antimicrobial peptides (AMPs) could be the solution to both problems, but they are currently limited by high cost, insufficient efficacy and stability as well as restricted chemical options for biotechnological production. However, in a group of marine animals: tunicates, there is a major, poorly characterized superfamily of AMPs with many advantageous natural chemical modifications. These unusual post-translational modifications (tryptophan bromination, arginine/lysine mono- and dihydroxylation, tyrosine hydroxylation, C-terminal amidation/oxidation) are predicted to improve potency and stability of the mature AMPs and might enable their efficient immobilization onto various surfaces. The latter property could also prove useful for surface coatings. In the current project, we aim to explore these promising bioproducts, from predictions by bioinformatics, through isolation of animal tissues, extraction and enrichment of the actual peptides, to their chemical analysis by mass spectrometry and testing of antimicrobial potency and safety. Project TuniPeps gives a major opportunity to both the applicant and host, to combine their complementary knowledge and skills in order to identify useful natural products from marine animals, acting as blueprints for future antimicrobials. These diverse molecules and their biosynthetic apparatus might also unlock cheap biotechnological production of novel molecules in the near future.

UNIPD Supervisor: Lucia Manni

MSCA Fellow: Andras Zeke

Department: Department of Biology

Coordinator: Università degli Studi di Padova (Italy)

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