Antimicrobial peptides as promising agents able to counteract the antibiotic resistance of bacteria and protozoa

The bleakest outlook for a “post-antibiotic era” is one in which microbial infections can no longer be cured. The traditional antibiotic pipeline has been exhausted, while antimicrobial resistance has become a multifaceted crisis, seriously threatening global health. There is thus an urgent and undeniable need for new antimicrobial treatments. Inspired by nature, antimicrobial peptides (AMPs) are rapidly gaining attention for their clinical translation, as they present distinct advantages compared to conventional antibiotics. They have demonstrated a pivotal role in the innate immune system of living organisms, and many are evolutionarily conserved with a limited propensity to induce resistance.

The main objective of this project is to synthesize, characterize and optimize some antimicrobial peptides, including temporin-like analogues, and peptides derived from enzymatic proteolysis of protein fraction isolated through innovative green technologies from natural sources, as well as a new library of peptides able to treat relevant infections associated with “priority pathogens” such as the flagellate protozoa Giardia duodenalis and multi-drug resistant bacteria responsible for nosocomial death such as *Enterococcus facium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter spp*. (ESKAPE). The chemical modifications of the peptides from our laboratories can be used to improve the biological activity and stability of the peptides and to reduce their potential cytotoxicity, if necessary. In more detail, the project intends to evaluate the in vitro efficacy of selected peptides in a large panel of bacteria as well as zoonotic pathogen isolates (Giardia and the ESKAPE bacteria) under conditions that better reflect the physiology of the target districts and to understand their stability.

Furthermore, the project intends to understand the fate of the most performing isolated active peptides in natural environmental compartments, analyze their mobility, bioavailability, and biodegradability, and study the environmental impact of their production.