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Abstract

This thesis investigates the therapeutic potential of peptide biologics in addressing two critical health challenges breast cancer and fungal keratitis through the application of antimicrobial peptides (AMPs) and cell-penetrating peptides (CPPs). By leveraging their inherent selectivity, membrane targeting ability, and low toxicity, this work aims to advance next-generation therapeutic strategies. Part I focuses on Ltc2a, a venom-derived AMP with strong anticancer properties. Ltc2a selectively targeted cancer cells, disrupted tumour structure, and significantly reduced tumour growth in a murine breast cancer model. Truncated variants revealed potential for targeted delivery. Importantly, *in vivo* safety studies, including zebrafish and mouse models, confirmed its excellent biocompatibility and lack of systemic toxicity. Part II explores the CPP Tat₂, which showed efficient, concentration dependent cellular uptake and strong interaction with anionic membranes. Tat₂ exhibited potent antifungal activity, effectively penetrated the cornea, and successfully resolved fungal keratitis *in vivo* without ocular or systemic toxicity. Its membrane interaction was non-disruptive, and its unstructured nature likely contributes to its functional flexibility. Together, Ltc2a and Tat₂ emerge as safe, selective, and multifunctional peptide therapeutics with strong translational potential for cancer and infectious disease treatment.