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Novel Synthetic Antimicrobial and Anti-biofilm Peptides (SAAPs)-containing coatings to prevent biomaterial-associated infection

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The use of medical devices has grown significantly over the last decades, and has become a major part of modern medicine and our daily life. Infection of implanted medical devices (biomaterials), like catheters, prosthetic heart valves or orthopaedic implants, can have disastrous consequences, including removal of the device. For still not well understood reasons, the presence of a foreign body strongly increases susceptibility to infection. These so-called biomaterial-associated infections (BAI) are mainly caused by *Staphylococcus aureus* and *Staphylococcus epidermidis*. Formation of biofilms on the biomaterial surface is generally considered the main reason for these persistent infections, although bacteria may also enter the surrounding tissue and become internalized within host cells (Riool *et al.*, Acta Biomater., 2014). Our work focuses on the development and characterization of novel antimicrobial agents and delivery systems, and their effectiveness in the prevention of BAI and other difficult-to-treat biofilm infections. The scarcity of current antibiotic-based strategies to prevent infections and their risk of resistance development prompted us to develop novel Synthetic Antimicrobial and Anti-biofilm Peptides (SAAPs) based on the primary sequences of the human antimicrobial proteins Thrombocin-1 and LL-37, and to test their potential in the fight against implant-associated and wound infections by multidrug-resistant bacteria. The lead peptide, SAAP-148, kills multidrug-resistant pathogens without inducing resistance, prevents biofilm formation and eliminates established biofilms and persister cells, and is effective against both acute and established skin infectionsde (de Breij & Riool *et al.*, Sci. Transl. Med., 2018). Currently, we are developing improved SAAPs. As a next step, we aim to develop antimicrobial coatings, such as a new polymeric supramolecular scaffold material, exerting two important functions: preventing microbial adhesion - by incorporating SAAPs - and thereby preventing biofilm formation, and inducing endogenous (eukaryotic) cells to adhere and propagate, as a first step towards functional tissue repair.