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Novel antimicrobial technologies for medical devices from BALI, IBIZA and PRINT-AID projects

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Room: SALA FERRARI – Dept. of Mechanical and Aerospace Engineering – 2nd floor

Implant-associated infections are one of the major causes of implant failure. The implant provides bacteria with a surface for adherence and biofilm formation. Within biofilms, bacteria are difficult to reach for antibiotics and host immune cells. Because of low metabolic activity in the biofilm, bacteria are up to >100-fold less susceptible to antibiotics. The second niche for bacteria is the peri-implant tissue. The combination of the implant as a foreign body material and the bacteria deranges antimicrobial immune response and may down-regulate macrophage intracellular bactericidal mechanisms, allowing bacteria to survive in tissue and even within macrophages.

We developed novel antimicrobial strategies to prevent and treat implant-associated infections and avoid antibiotic resistance.

In the BALI (Biofilm Alliance) consortium project, we developed anti-biofilm agents in the form of Synthetic Antimicrobial and Antibiofilm Peptides (SAAPs). These SAAPs have broad spectrum, very rapid microbicidal and anti-biofilm activity, no detectable resistance development, activity in human plasma, and prevent implant–associated infection in mouse and rabbit models, as well as skin biofilm infection by multi drug resistant Staphylococcus aureus (MRSA) and *Acinetobacter baumannii.*

In the IBIZA (Imaging of Biomaterial-associated Infection using Zebrafish Analysis) consortium project, we developed a novel method to eradicate intracellular bacteria. Common antibiotics do not kill intracellular bacteria, since the bacteria are residing within phago(lyso)somes, while the antibiotics are entrapped in other endosomes. We developed a photosensitizer-based approach and were able to kill intracellular staphylococci in macrophages in vitro using gentamicin, and to rescue zebrafish embryos from lethal Staphylococcus aureus infection.

In the Horizon 2020 ITN training network, we aim to produce antimicrobial medical devices by additive manufacturing (“3D-printing”). Design of the program and initial results will be presented.