Seminar

“IRTG: Soft Matter Science “

Synthetic Mimics of Antimicrobial Peptides – New Polymeric Materials for the Fight Against Multiple Resistant Bacteria

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“Hörsaal Makromolekulare Chemie”,
Stefan-Meier-Str. 31, Freiburg

You are welcome to meet Karen Lienkamp after the seminar. Do not hesitate to contact Christelle Vergnat (softmattergraduate@physik.uni-freiburg.de) to organize a meeting.

With antibiotic resistant ‘superbugs’ like multiple resistant *Staphylococcus aureus* (MRSA) spreading, polymers with antibacterial properties are becoming increasingly important for a wide range of applications in high infectious risk areas, including surgical implants and medical devices.

We have previously reported the synthesis and characterization of polymers that mimic antimicrobial peptides (AMPs), a vital component of the innate immune system. These Synthetic Mimics of Antimicrobial Peptides (SMAMPs) were designed to capture the key features of AMPs, i.e. positive charges that induce attachment to bacteria membranes, and hydrophobic groups that trigger membrane disruption. The polymers were obtained by ring-opening metathesis polymerization (ROMP) of facially amphiphilic monomers. Using hydrophobicity, monomer feed ratio and molecular weight as parameters to tune the antimicrobial properties and the toxicity, highly active and selective polymers were discovered. [1] Broad-spectrum antimicrobial testing revealed that some of these polymers were 50 times more selective for Gram-positive over Gram-negative bacteria while other polymers surprisingly showed the opposite preference. This kind of ‘double selectivity’ (bacteria over mammalian cells and one bacterial type over another) is unprecedented in other polymer systems and is attributed to the monomer’s facial amphiphilicity. Some polymers also showed activity against MRSA and are thus promising candidates for materials applications. [2, 3]

We here present our recent progress in the generation of antimicrobial and antibiofouling surfaces from SMAMPs. These surfaces were obtained by grafting-onto as well as grafting-from techniques, and were studied using ellipsometry, XPS, AFM and microbiological assays. Film thicknesses from 5 -150 nm were obtained. When exposed to *S. aureus*, some surfaces were found to kill 97% of the bacteria present.

[1] **K. Lienkamp**, A. E. Madkour, A. Musante, C. F. Nelson, K. Nüsslein, G. N. Tew, Antimicrobial Polymers Prepared by ROMP with Unprecedented Selectivity: A Molecular Construction Kit Approach. *J. Am. Chem. Soc.* **2008**, *130*, 9836

[2] **K. Lienkamp**, A. E. Madkour, K.-N. Kumar, K. Nüsslein, G. N. Tew. Antimicrobial Polymers Prepared by Ring-Opening Metathesis Polymerization: Influencing Antimicrobial Properties By Charge Density Variation and Ion Exchange. *Chem. Eur. J.*, **2009**, *15*, 11710

[3] **K. Lienkamp**, K.-N. Kumar, A. Som, K. Nüsslein, G. N. Tew. Doubly Selective Antimicrobial Polymers – How Do They Differentiate Between Bacteria? *Chem. Eur. J.* **2009**, *15*, 11715

[4] **K. Lienkamp**, G. N. Tew. Synthetic Mimics of Antimicrobial Peptides – A Versatile ROMP-based Platform for the Synthesis of Selective Antibacterial and Cell Penetrating Polymers. *Chem. Eur. J.*, **2009**, ASAP.