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ADLERSHOFER KOLLOQUIUM

Topic: New concepts for lab-on-a-chip systems using electrospun nanofibers

Presenter: Frau Prof. Dr. Antje J . Baeumner
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Chair: Dr. Ute Resch (BAM)

Date: 2 February, 2016
2:00 PM

Location: Federal Institute for Materials Research and Testing (BAM)
Branch Adlershof, Richard-Willstaetter-Str. 11, 12489 Berlin
Building 8.05 / Lecture Hall

Summary:

Microfluidic biosensors, labs-on-a-chip and lateral flow assays for the detection of viable organisms, toxins, and clinically relevant markers have been successfully developed in our research group including analytes such as B. anthracis, C. parvum, dengue virus, E. coli, S. pyogenes, cholera toxin, CD4+ T-lymphocytes, thrombin and myoglobin.

Recently, we initiated the study of electrospun nanofibers and their immense potential to enhance bioassays. The great variety of chemical surfaces available and the large surface-to-volume ratio promise to solve challenges of signal enhancement, non-specific binding and analyte pre-concentration. We have therefore studied nanofibers in paper-based lateral-flow assays (LFA) and in microfluidic systems. For example, we have studied the de novo fabrication of nanofiber-mats as membrane material adding novel surface chemistries and preventing non-specific binding without the use of blocking reagents. In the case of microfluidic systems, we focus our studies currently on the use of nanofibers as sample preparation material, as immobilization support matrix and as transducer-element. We have demonstrated that bacterial cells can be pre-concentrated through 3D nanofiber mats in microfluidic channels. Nanofiber materials were chosen to selectively isolate E. coli cells from solution while preventing non-specific binding. We were also able to functionalize the nanofibers by bearing biotin on the outer surface without the need of any additional chemical step by adding biotin to the original spinning dope. Finally, interestingly, we have demonstrated that the 3D nanofiber mats can also function as mixers within microfluidic systems. They therefore enhance the bioassay not only through their immense surface area but also by decreasing diffusion limitations. New studies will integrated signaling molecules directly into the nanofibers to take advantage of their unique capabilities.