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Automated detection of biological threats with a centrifugal lab-on-a-chip system

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Abstract

The world's growing mobility, mass tourism and the threat of terrorism has tremendously increased the risk of rapid spread of infectious microorganisms and toxins. Therefore, there is a continuously growing demand for small, mobile, and easy-to-use diagnostic systems for the automated detection of infectious and lethal agents directly at the point-of-need. However, the currently used technologies for pathogen detection require relatively large instruments, complex bioanalytical procedures and highly skilled analysts, which seriously limit the rapid and efficient response, as desired for the effective tacking of emergency situations. We have developed a potential centrifugal lab-on-a-chip (LOAC) system for the automated detection of biological threats. It involves the LabDisk platform and a portable fully automated LOAC system that performs complex biochemical analyses at the point-of-need. It was employed for the detection of *Botulinum* neurotoxin by automated luciferase reporter assay in addition to the detection of *Bacillus anthracis* and *Francisella tularensis* by nucleic acid analysis. The reporter assay detects *Botulinum* neurotoxin in samples such as milk, soup and blood plasma in the concentration range of 8 pM – 6 nM in less than 30 minutes. It is based on the detection of the proteolytic activity of the toxin's light chain, the purified toxin as well as the toxin in multi-protein complex form. On the other hand, the nucleic acid analysis detects *Bacillus anthracis* and *Francisella tularensis* via isothermal polymerase amplification in less than 45 minutes.

Biography

Thomas van Oordt studied Chemistry at ZHW Zurich and Micro- and Nanotechnology at Vorarlberg University of Applied Sciences. He has several years' experience in the chemical industry developing production methods for active pharmaceutical ingredients. Since 2009 he has been a project leader at HSG-IMIT in Freiburg, Germany with a focus in centrifugal microfluidics.

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