Group : MicroFluidics and Nanotechnology
Project : **Point-of-care detection of Lyme disease**
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Introduction

In The Netherlands, about 1.1 million people are bitten by ticks annually. Tick bites are mostly harmless, but 2 out of 100 people will develop Lyme disease as a result of a tick bite. The causative agent of the tick-borne Lyme disease is the *Borrelia burgdorferi* bacteria. In the Netherlands, 20% of the ticks are infected by the *B. burgdorferi* bacteria. If treated with appropriate antibiotics the chance of rapid and complete recovery from the infection is much higher, while the chance of developing chronic Lyme disease is much lower. However, a fraction of the people bitten by a tick will still develop chronic Lyme disease, due to the lack of a specific, reliable and conclusive test in the diagnosis. Almost all commercially available tests for the detection of Lyme disease are based on the monitoring of the immune response of the infected patient and, therefore, should be considered as indirect detection methods. The key issue is that during the first 4-6 weeks of Lyme infection, most infected people do not yet develop Borrelia-specific antibodies and, even in later stages, only 50-70% of the patients show a detectable immune response.
In order to develop more direct detection methods, we want to target the outer surface proteins (Osp) of *B. burgdorferi:* OspA and OspB. This will be done on microsieves modified with a zwitterionic antifouling layer and covalent coupling of the respective antibodies using EDC/NHS chemistry. Microsieves are very thin perforated membranes with a macro-perforated support structure to strengthen the thin membrane (Figure 1). This allows flow-through of bodily fluids and gives superior transport speed of the analytes to the bioactive surface compared with conventional flow-over biosensing formats. Ultimately, we want to integrate this into a Point-of-care diagnostics device (Figure 1).

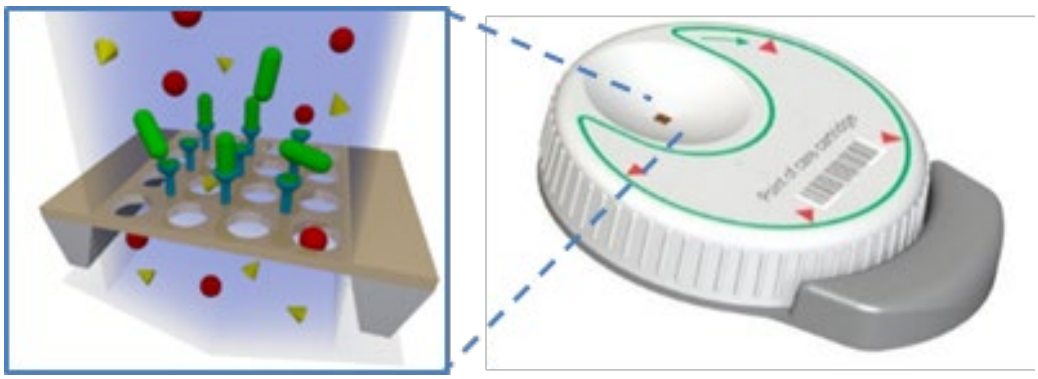

Figure 1. Artist impression of the prototype LymeSieve device, manually operated by a rotating knob and featuring an embedded microsieve for biorecognition and pre-loaded (bio)reagents for detection and absorbers for microfluidic transport.

Goal

To investigate biorecognition of *B. burgdorferi* through covalent immobilization of antibodies onto antifouling microsieve surfaces and demonstrate the applicability of the prototype assay for the detection *B. burgdorferi bacteria* of in bodily fluids, e.g. blood and urine

Techniques to be used

Surface modification, , microfluidics, fluorescence and optical microscopy, SEM, XPS.

For more information

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