Titolo (provvisorio): Integration of synthetic Tuberculosis DNA target processing and optomagnetic detection of rolling circle DNA amplification on a three chamber polymer chip

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Descrizione

Motivazione e campo di applicazione

The general aim is to develop low-cost disposable chips with a simple optical/magnetic readout for detection of DNA targets. Targets include infectious diseases such as tuberculosis.

Obiettivi generali e principali attività

We want to use Padlock Probe (PLP) recognition principle to detect one base mutation in M.Tuberculosis DNA target that is responsible for its resistance towards antibiotics. In the first step DNA targets are attached to a carrier (magnetic microbeads) and can be moved to the next processing step.

In the next step, we use rolling circle amplification (RCA) to increase number of DNA copies produced by an enzymatic extension of the target hybridized to fully matching circular template with continuous displacement of the synthesized DNA concatemer. We use functionalized magnetic nanoparticles (MNPs) to detect the DNA products of RCA (RCPs) so that MNPs bind on multiple sites of the RCPs and form clusters simultaneously with amplification.

All experiments will be carried out in the optomagnetic 3-chamber chip setup. The sensor signal relies on depletion of single MNPs (turn off signal) and accumulation of MNP clusters lacking behind the magnetic field phase.

Obiettivi di apprendimento (strumenti tecnici e analitici, metodologie sperimentali)

The student will get "hand'on" experience on the following aspects:
- lab-on-a-chip design, fabrication, characterization and integration
- molecular amplification and detection schemes (DNA)
- molecular amplification on a chip (transfer of lab assay to chip)
- real-time optomagnetic characterization of molecular amplification processes
- optimization and characterization of optomagnetic detection of DNA

Luogo/i in cui si svolgerà il lavoro: Department of Micro- and Nanotechnology, Danish Technical University, Danimarca

Informazioni aggiuntive

Abilità e capacità richieste: Good English language communication skills

Numero massimo di studenti: 1