Aptamers

Concept

**Motivation**
- Many patients suffer from severe inflammatory responses after implantation of vascular implants.
- Improvement of biocompatibility of vascular implants by coating with endothelial progenitor cells (EPC) in vitro.
- EPCs are used as EPC specific capture molecules [1] on the implant surface to select autologous EPCs directly out of the bloodstream.
- EPCs proliferate into non-thrombogenic endothelium and minimize risk of inflammation.

**Capture and assembly of living cells by dielectrophoretic forces between interdigitating electrodes on the bottom of the microfluidic channel** [2] (3).

**Aptamers** are used as EPC specific capture molecules [1] on the cell surfaces. Unbound aptamers are again flushed out. (4)

**Improvement of biocompatibility of vascular implants by coating with endothelial progenitor cells (EPC) in vitro.**

**Utilizing dielectrophoretic and electrophoretic forces in a microfluidic system for the selection of EPC specific aptamers.**

**Reduction of false positive hits by decreasing the number of dead cells in the assay during dielectrophoretic assembly.**

**In-flow incubation of assembled cells with aptamer molecules.**

**Utilizing the charge of the aptamers for electrophoretic separation of unspecifically bound aptamers from cell surfaces.**

**Innovation**

**Aptamers**
- Short RNA or DNA oligonucleotides (25 to 90 nucleotides).
- Show high binding affinity and specificity to the 3D structure of the target molecule.

**Microfluidic chip**

Figure 1: Schematic representation of the steps for obtaining specific cell surface binding aptamers in our microfluidic chip: (1) Cell assembly

Dielectrophoresis

Cells are assembled by positive dielectrophoresis.

Enrichment of viable cells reduces unspecific aptamer binding.

Cells are retained by dielectrophoresis during incubation with aptamers.

**Fluid flow**

- Aptamers flowing through channel are evenly distributed along channel width.
- Uniform incubation of assembled cells with aptamers in-flow is possible.

**References**


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