



NGM Open Call Reference Case

SPERM SELECTION CHIP TO INCREASE CHANCES OF IN-VITRO FERTILIZATION

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MEPROlife s.l.

OVERVIEW

Over 186 million people worldwide struggle with infertility issues during their reproductive lifetime. Current in-vitro fertilization techniques require multiple cycles, involving additional costs, time and distress to the patient. Sperm selection techniques are often employed to reduce the number of cycles required to achieve pregnancy. MEPROlife's unique SpermSort technology employs microfluidics to combine motility-based selection with a theragnostic assay which excludes sperm containing the biomarker CD10, associated with low-viability sperm, and has been demonstrated to increase pregnancy rates by up to 38% in comparison to gold standard methods for sperm selection set by the World Health Organization.

Starting Point MEPROlife

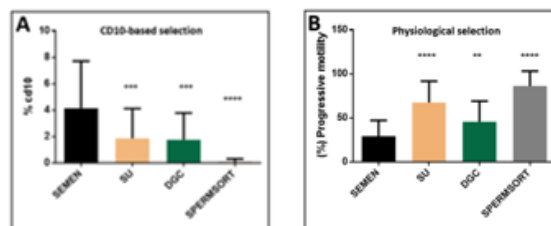
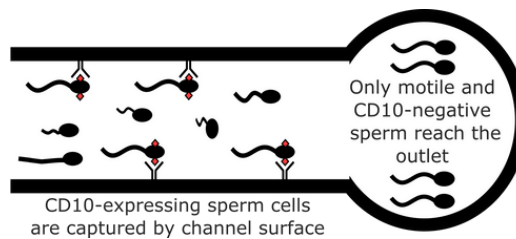
MePro has developed an injection moulded microfluidic chip and a surface functionalization protocol for the channels with anti-CD10 antibodies.

Inquiries to MIH

- Transfer of microfluidic chip manufacture from injection moulding to roll-to-roll manufacture, for high volume/ lower cost manufacture and increased reproducibility.
- Exploration of aptamer-based CD10-positive sperm capture, rather than antibodies, allowing for lower cost and improved sterilization.

WORKING PRINCIPLE

Sperm introduced through the inlet undergo a simultaneous physiological and biochemical selection process. Motile sperm cells travel towards the outlets quicker than non-motile sperm cells, and CD10+ sperm cells are captured and hindered by surface-bound antibodies.



Comparative analyses between control semen, gold standards (SU: Swim up and DGC: Density Gradient), and SpermSort technology in both CD10-based (A) and physiological (B) parameters.

PROJECT

Scope:

- Budget: 133,324€
- Funding Rate: 85% (113,521€)
- Duration: 10 months
- NGM Partners: Biomedical Research Foundation of the Academy of Athens, Fundacion Tecnalia Research & Innovation, Micronit b.v., Inmold A/S

Solution highlights:

- High volume / low-cost manufacture.
- Surface chemistries to tailor wettability and immobilize biorecognition molecules.
- Sterilized and biofunctionalized microfluidic cartridge ready for use.
- Transferrable to other biomarker selection protocols.

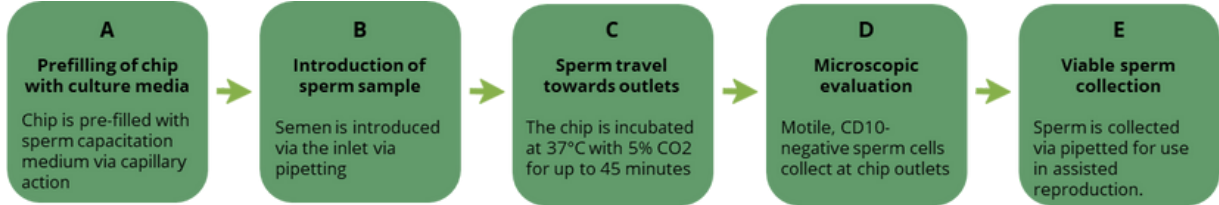
TECHNICAL IMPLEMENTATION

Summary

Sperm sorter Lab-on-a-foil based on simultaneous physiological and molecular selection.

NGM partners together with MEPROlife have redesigned their existing prototype for a microfluidic chip that separates the most viable sperm cells from a sample. This relies on a dual methodology, as the chip is designed so that only motile sperm cells propel themselves from the inlet to the outlet, and simultaneously, sperm cells expressing the low-viability biomarker CD10 on their surface are hindered by anti-CD10 antibodies present on the microfluidic channel surface.

Process

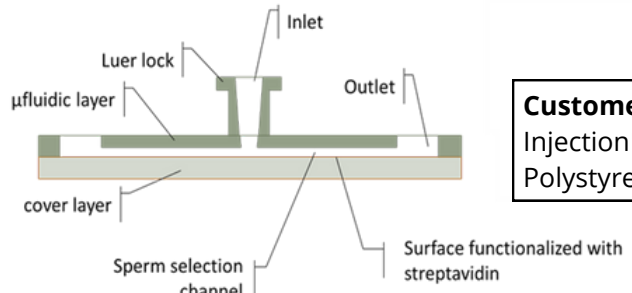


Materials:

- Cyclic Olefin Copolymer (COC)

Manufacture:

- Extrusion coating roll-to-roll (EC-R2R).
- Ultrasonic welding of patterned substrate to polymer lid.

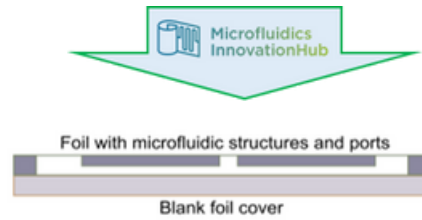


Customer solution:
Injection moulded
Polystyrene

Design

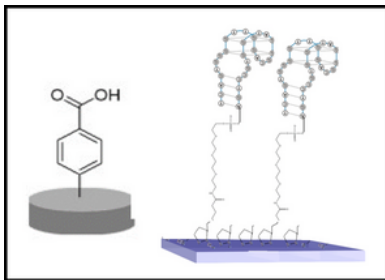
Requirements:

- Passive capillary filling
- Anti-backflow design
- High surface-to-volume ratio
- Microscopy slide dimensions
- Sterilized
- Optimized surface functionalization

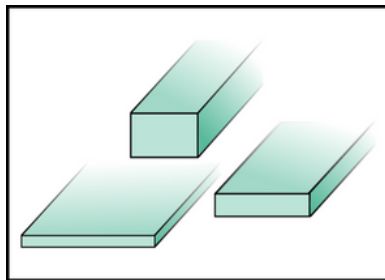


Project target:
Roll-to-roll
COC

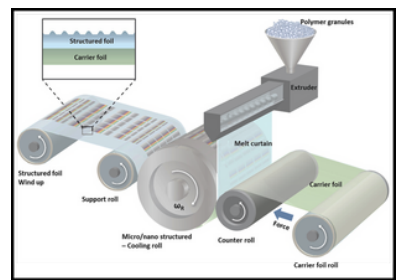
Features



Optimization of surface biofunctionalization protocols with antibodies or aptamers. Application of durable, widely-applicable chemistries that are sterilizable and tailor COC surface properties to enhance flow performance.



Optimization of channel dimensions and aspect ratios to simultaneously enable efficient capillary filling of channels, whilst maximising surface area-to-volume ratios for efficient sperm cell capture.



Transfer of customer's injection moulded design and manufacture to a high volume, extrusion-coating roll-to-roll manufacture, enabling low, footprint (microscope slide dimensions), low cost, high aspect ratio channels, and sterilizable polymer channels

Value Chain

