Spermatozoa on chip

Introduction

Involuntary childlessness is a problem, which about one out of six couples have in the Netherlands. These couples can be treated with assisted reproductive technologies, such as *in vitro* fertilization (IVF) or intracytoplasmic sperm injection (ICSI). Currently more than 5 million babies are born worldwide using these techniques.

Before these treatments are started, first the semen of the man is assessed by determining parameters such as the concentration and motility of the spermatozoa. The result of the analysis is used as input in the treatment decision made by the gynaecologist. Additionally often the semen needs to be prepared before it can be used for the treatment. For example with ICSI, the laboratory technician has to choose the spermatozoon which will be injected in the oocyte. This one is selected based on the morphology and motility, thereby skipping the normal selection procedures which are present in the female body.

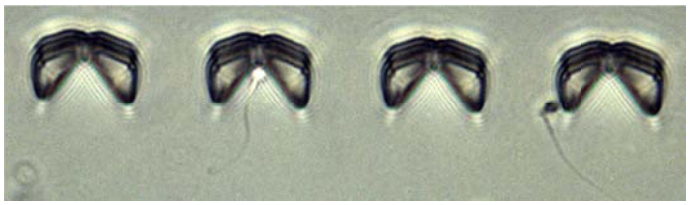

Figure 1. Trapping of invididual spermatozoa using microstructures.

The assessment and selection of spermatozoa is not only restricted to applications in the human world. For the veterinary world, in some cases the spermatozoa are sorted based on the gender chromosome (X or Y) they carry. For this fluorescence activated cell sorting (FACS) can be used, where only about 20% of the cells are sorted [1].

Research description

Within the BIOS group, we are currently developing microfluidic platforms to overcome the problems encountered with spermatozoa assessment and selection. We already showed that a microfluidic chip can be used to assess the motility and concentration of a semen sample [2], but this still needs to be validated before it can be used in the hospital. Besides that, other parameters, such as DNA integrity and morphology, contain also information which can be used for assessment and selection. For this the individual spermatozoa needs to be trapped (figure 1), assessed and/or sorted on-chip and for this several techniques will be used such as electrical impedance cytometry (figure 2) and dielectrophoresis.

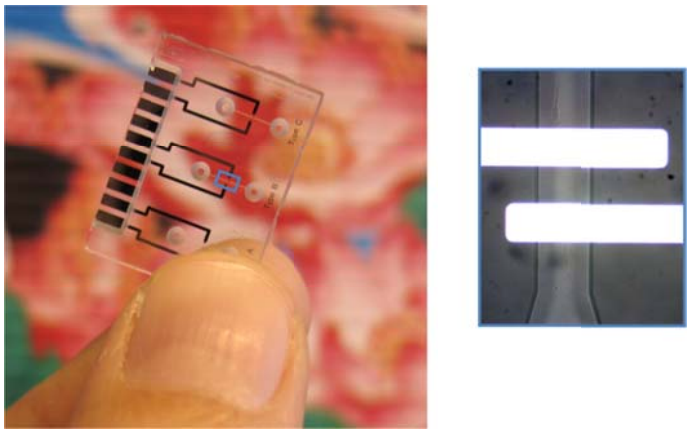

Figure 2. Example of the chip that has been used to detect single spermatozoa in a microfluidic channel using electrical impedance cytometry.

Interested?

If you have questions or just want to do a bachelor or master assignment at this project, please contact:

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References

1. Seidel, G.E. and D.L. Garner, *Current status of sexing mammalian spermatozoa.* Reproduction, 2002. **124**: p. 733-743.
2. Segerink, L.I. *Fertility chip, a point-of-care semen analyser*. PhD thesis, 2011, University of Twente