UNIVERSITY OF AMSTERDAM

FORENSIC LITERATURE THESIS

LITERATURE THESIS

Title	: *Single cell DNA-analysis on-chip*
Keywords	: DNA-analysis, microfluidics, lab-on-a-chip, single cell
Forensic Expertise Area	: *DNA-analysis*
Department	: -
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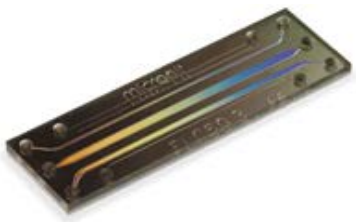
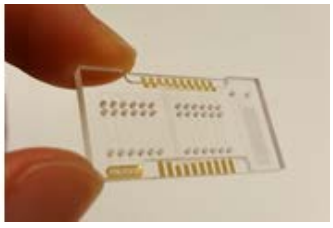
SHORT DESCRIPTION

Unfortunately, biological traces found on the crime scene often contain a limited amount of DNA. This while the DNA success rate is highly dependent on the DNA concentration [1]. Another issue is the complexity of mixed profiles, whereby it is not always possible to assign a DNA-profile to the perpetrator. By amplifying single cells by e.g. WGA and subsequently STR-PCR these two problems can be overcome. However, these processes are time consuming and require a substantial number of manual steps, which might result in contamination of the sample. A lab-on-a-chip (LOC) or a microfluidic device (see some examples in the picture below) can be described as a system in which multiple conventional lab techniques can be combined in one device with a footprint of several square centimetres. These devices consist of enclosed microchannels, whereby the changes of contamination are reduced. Other benefits of these kind of systems are that less sample and reagents are required, shorter reactions times and the small footprint make these devices suitable for use directly at the crime scene [2].

In this literature study we would like to investigate the possibilities of on-chip WGA for subsequent (off-chip) STR-PCR.

The following research questions need to be answered:

- Whole genome amplification:
  - What is WGA and how does it work (short description)?
  - How can WGA be used before STR-PCR?
  - What are the advantages and disadvantages of using WGA before STR-PCR?
  - What are the results with single cell WGA? And with a minor number of cells (< 10)?
- On-chip WGA:
  - Which chips exist for WGA on-chip? Give detailed specifications (e.g. chip material, amplification time, kit used, amplification yield and amount of DNA used as input).
  - Can on-chip WGA be used for forensic applications?

Analysis of specific (on-)chip aspects is not part of the literature research. Micronit has enough experience on that aspect. Also, PCR on-chip is out of scope for this literature research.

REFERENCES

1. Mapes, A.A.; Kloosterman, A.D.; van Marion, V.; de Poot, C.J. Knowledge on DNA Success Rates to Optimize the DNA Analysis Process: From Crime Scene to Laboratory. *J. Forensic Sci.* **2016**.
2. Bruijns, B.; van Asten, A.; Tiggelaar, R.; Gardeniers, H. Microfluidic devices for forensic DNA analysis: A review. *Biosensors* **2016**.

REQUIRED/RECOMMENDED EXPERTISE

- Amplification techniques (preferably WGA or other non-PCR methods)
- Affinity with nanotechnology/microfluidics