

Lab-on-a-chip helps search for human DNA at crime scenes

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Thanks to the work carried out by University of Twente Ph.D. candidate Brigitte Bruijns, crime scenes can now be inspected on the spot for the presence of human DNA. In her Ph.D. thesis, she describes a lab-on-a-chip that rapidly indicates whether a trace discovered at a crime scene contains human DNA and, thus, whether it should be examined in the laboratory.

Every year, the Netherlands Forensic Institute (Nederlands Forensisch

Instituut, NFI) carries out more than 100,000 DNA analyses. Half of them do not result in usable DNA profiles and are only fit for the bin. This will soon be history thanks to the lab-on-a-chip investigated by Bruijns. This technological breakthrough clearly indicates whether a trace discovered by a [police officer](#) or forensic expert is worth further examination. The answer 'NO' means that he or she should move on immediately and look elsewhere for traces that are usable. The answer 'YES' means that human DNA is present and that the trace is to be taken to the forensic laboratory for DNA profiling.

This indicative screening is carried out using a lab-on-a-chip, a miniscule device on which various laboratory techniques are integrated. The device only needs a minimal [sample](#) to be able to analyse a trace. Its closed system enables immediate analysis at the crime scene and the risk of (cross-)contamination is greatly reduced.

In her Ph.D. thesis, Bruijns describes the five steps that are integrated on the lab-on-a-chip:

1. Sampling. Forensic experts currently use swabs, which are similar to cotton buds, to take samples and this is where. A lot of cells remain behind on the swab and can no longer be removed from it.
2. The workup of the DNA sample. Or, in other words, the lysis of cells. This is the breaking down of cells to get at the DNA, possibly followed by extraction and purification.
3. In practice, there are often tiny quantities of DNA at a crime scene. Amplification of the DNA is therefore necessary.
4. Detection, which is often realized using a fluorescent dye. Here, the lab-on-a-chip provides the answer to the question of whether there is or isn't any human DNA present.
5. Storage of the DNA for further analysis in the laboratory.

"This lab-on-a-chip is like a sort of pregnancy test," Bruijns says. "Forensic experts see a 'YES' or 'NO' within 30 minutes. The fact that half of all samples do not result in human DNA profile, and are therefore worthless, is very frustrating for professionals in the forensic world. Investigating all the reasons for this would be a study in itself. Sampling requires more study. Many samples contain little DNA and the probability of achieving a good profile is closely related to the quantity of DNA you have. The sample may be damaged, for example, if it is very hot and humid or if the sample is exposed to a lot of UV light."

According to Bruijns, her device is the first of its kind in the world of forensic research. "There are already tests that can be carried out on site to show whether a sample contains human blood, saliva, semen or urine, but this study describes the preceding step in the process."

In theory, Bruijns' study could bring about enormous changes in the professional practice of forensic research. Police officers and forensic researchers will have to learn how to use the [lab-on-a-chip](#) and the likelihood of obtaining usable DNA profiles will be higher.

Brigitte Bruijns conducted her study in collaboration with the NFI. Bruijns graduated from the Bachelor's programme in Advanced Technology and the teacher training programme in chemistry at the University of Twente and went on to complete the Master's programme in Forensic Science at the University of Amsterdam. Bruijns also lectured for the Forensic Research educational programme at Saxion University of Applied Sciences.

Provided by University of Twente

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