Proximity ligation assay for biomarker analysis in fingermarks

Short description - Fingermarks are among the most important types of physical evidence that can be encountered at the crime scene, since their characteristic ridge pattern can be used for identification. Fingermarks are composed of materials derived from sweat excreted via the pores present in the skin, but can also contain contaminants originating from the environment. Thus, when depositing a fingermark, each individual will also leave a unique chemical profile that can be used to create a donor profile. Importantly, in case of a poor quality fingermark or when no reference fingerprint is present in the fingerprint database, this additional chemical information might give clues about the donor (e.g. sex, blood type, diet and drug usage) (1,2).

Since fingermarks are minimal samples, with biomarkers present in trace amounts, the aim is to develop an extremely sensitive and specific method, which involves the use of a proximity based ligation assay (PLA). In a PLA, matched antibody pairs are conjugated to 5' and 3' oligonucleotide probes. When both antibodies are in close proximity, connector oligonucleotides will hybridize to the free ends of their oligonucleotides and will be joined together by enzymatic DNA ligation, forming an amplifiable template for polymerase chain reaction (PCR). The amplification step enables the measurement of very few ligation products, meaning an extremely sensitive detection. The use of this dual recognition mechanism creates also a highly specific assay (3,4,5).

Required/ recommended expertise - We are looking for a master student with a biomedical- or chemistry background. Basic knowledge of immunogenic and PCR analysis is beneficial, but further training can be offered. Its required that the student can work with human material. The anticipated starting date is August/ September 2022.

Interested in this project? Please send your CV and motivation letter to

Annemieke van Dam
Biomedical Engineering and Physics
Amsterdam Medical Centre
annemiekevandam@amsterdamumc.nl

References

1. van Dam, A., van Beek, F. T., Aalders, M. C. G., van Leeuwen, T. G. & Lambrechts, S. A. G. Techniques that acquire donor profiling information from fingermarks - A review. *Sci. Justice* **56**, (2016).
2. Ferguson, L. S. *et al.* Direct detection of peptides and small proteins in fingermarks and determination of sex by MALDI mass spectrometry profiling. *Analyst* **137**, 4686 (2012).
3. Kozlov IA, Melnyk PC, Stromsborg KE, Chee MS, Barker DL, Zhao C. Efficient strategies for the conjugation of oligonucleotides to antibodies enabling highly sensitive protein detection. Biopolymers. 2004 Apr 5;73(5):621-30. doi: 10.1002/bip.20009. PMID: 15048786.
4. Fredriksson, S., Dixon, W., Ji, H. *et al.* Multiplexed protein detection by proximity ligation for cancer biomarker validation. *Nat Methods* **4,** 327–329 (2007). https://doi.org/10.1038/nmeth1020
5. Gustafsdottir SM, Schallmeiner E, Fredriksson S, Gullberg M, Söderberg O, Jarvius M, Jarvius J, Howell M, Landegren U. Proximity ligation assays for sensitive and specific protein analyses. Anal Biochem. 2005 Oct 1;345(1):2-9. doi: 10.1016/j.ab.2005.01.018. Epub 2005 Feb 7. PMID: 15950911.