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Towards the development of basic technological bricks for a Traumatic Brain Injury diagnostic cartridge

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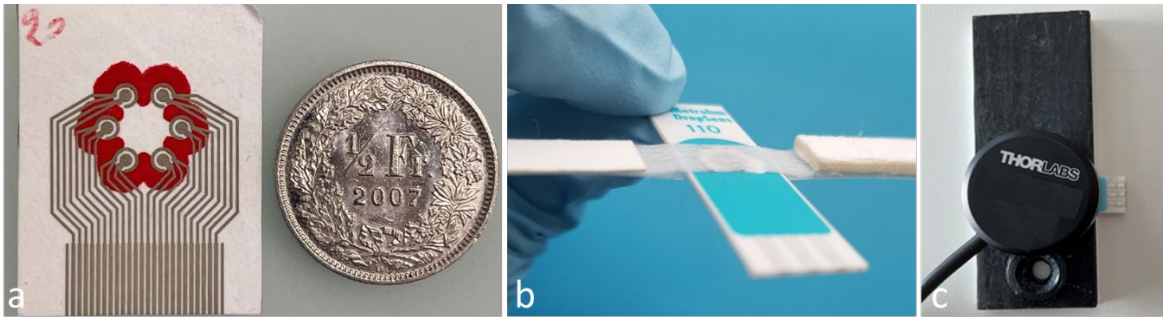
This study focuses on the development of the necessary building blocks for the creation of a Point-Of-Care (POC) diagnostic for the detection of Traumatic Brain Injury (TBI). The development of such a POC diagnostic strives to replace complex, expensive and time-consuming clinical processes for the detection of body fluid biomarkers in the laboratory. This POC diagnostic is based on the combination of reader and consumable (cartridge) concept. Blood separation, plasma transportation on the electrodes and detection of the biomarkers are the most important functions that the technological bricks should enable. Both, Lateral Flow Assay (LFA) and vertical Flow Assay (VFA) concepts provide promising platforms for the accomplishment of these functions. The blood separation is achieved by the integration of a polysulfone filter at the inlet of the cartridge. The plasma transportation function is satisfied by exploiting the inherent capillarity effect of each assay concept. Two detection techniques are explored during this study, namely the electro-impedance spectroscopy (EIS) and the electrochemiluminescence (ECL). Progress in the development of these technological bricks shows promising results. Possible advantages of such a TBI POC diagnostic are early diagnosis, low-cost fabrication, high availability, inherent liquid flow characteristics, compatibility with low volume samples, biocompatibility, biodegradability, direct digitalization of data and decentralized testing.



Photographic views of technological bricks in development for a Traumatic Brain Injury diagnostic cartridge: a) Miniaturized EIS sensor fabricated on paper using a low-cost printing technique for both electrodes and hydrophobic barriers; b) Integration of a commercial electrode into an LFA strip; c) LFA cartridge demonstrator with integrated ECL detection.