

Abstract

Development of an Automated System for the Analysis of Cell-Free Fetal DNA from Maternal Plasma for Non-Invasive Pre-Natal Diagnostics [†]

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The analysis of circulating cell-free (cf) DNA from plasma, serum or urine, has the potential to serve as a non-invasive approach to detect and monitor targets associated with certain diseases. In 1997, the presence of fetal DNA in the plasma and serum of pregnant women was demonstrated [1]. This opened new perspectives in the field of non-invasive pre-natal diagnostics since the analysis of cell-free fetal (cff) DNA can provide information about pregnancy-related disorders (pre-eclampsia, pre-term labour), chromosomal aberrations (aneuploidies) and genetic disorders (cystic fibrosis, thalassaemia, Huntington's disease) [2].

We report on the development of an automated and integrated modular system for the isolation, amplification and detection of cffDNA from maternal plasma for non-invasive pre-natal diagnostics. The system consists of a first module for the cfDNA isolation from plasma based on silica-coated magnetic beads technology. Subsequently, the cfDNA obtained is introduced to a second module which is based on a polymeric microsystem containing a capillary electrophoresis step for the size separation of the fetal DNA from maternal DNA. Finally, the cffDNA is transferred to the amplification/detection module. This module consists of PCB (Printed Circuit Board) electrode arrays functionalized with surface immobilised primers for the multiplexed isothermal recombinase polymerase DNA amplification (RPA) and electrochemical quantitative detection of specific genetic sequences.

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