

TITLE: Integrated Cell Separation and DNA Extraction on a Microdevice for DNA Analysis of Sexual Assault Evidence

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TEXT:

Conventional differential extraction, for isolating male and female DNA fractions from sexual assault evidence, is a time-consuming laboratory process not easily translated to a microchip format. An alternative method has been developed that reduces the time necessary to separate these fractions, while maintaining the recovery and purity of each. The integrated design combines a microdevice method for separation of sperm cells from epithelial cells, with on-chip cell lysis and solid phase extraction of male and female DNA from the separate cell fractions. This microdevice allows input of a complex forensic sample and provides purified male and female DNAs suitable for genetic identification using short tandem repeat (STR) analysis.

Separation of sperm from vaginal epithelial cells recovered from a vaginal swab exploits differential physical properties between the two cell types. Cell density and absorbitivity of the epithelial cells allow them to settle and remain in the inlet reservoir while pressure flow directs sperm cells through a microchannel. STR analysis has been utilized to demonstrate the purity of the cell fractions collected. This separation method has been integrated with on-chip chemical cell lysis, followed by microchip solid phase DNA extraction on sol-gel/silica bead extraction matrices. Microchip DNA extraction results in PCR-amplifiable DNA consistent with that obtained by conventional methods, indicating that the integrated device will allow rapid analysis of forensic samples with similar or improved performance as compared with macroscale laboratory techniques.

Key Terms: DNA extraction, differential extraction, microdevice