A NEW GENERATION-DIFFERENTIAL EXTRACTION METHOD FOR SPERM ISOLATION ON-CHIP

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Development of a method for rapid and efficient processing of sexual assault evidence will help accelerate forensic investigation and reduce casework backlogs. Processing of sexual assault evidence generally requires separation of the victim's cells (epithelial) from the perpetrators cells (sperm) and involves time consuming steps of selective cell lysis, centrifugation and separation into female and male DNA fractions. Currently, no rapid sperm isolation and differential extraction technology, which includes both sperm isolation and quantitation is available.

Here, we report a microfluidic platform and imaging technology that incorporate a novel sperm capture and differential extraction strategy with a high-resolution holography imaging. To isolate and capture sperm cells in samples, the microchips are decorated with a unique oligosaccharide (*i.e.,* sialyl-Lewis^x sequence), which locates on the extracellular matrix (*i.e.,* zona pellucida (ZP)) of the oocyte that represents a ligand for human sperm-egg binding. Our disposable microchips are designed to mimic egg surface binding to capture sperm using the sialyl-Lewis^x sequence. The whole process including microchip-based sperm cell isolation, DNA fraction, and holographic imaging takes only 15-30 minutes, and provides the results with ~70 - 92% of capture efficiency, thus accelerating downstream process in forensic analysis. This platform also allows efficient and selective separation of sperm from epithelial cells in sexual assault evidence samples with a 92% of specificity. In collaboration with the Broward County Sheriff's Office, we have further demonstrated that the developed microchips can selectively capture sperm from aged and mock sexual assault samples in a cost effective manner.

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