SPERM CELL PURIFICATION FROM MOCK FORENSIC SWABS USING DNA SOMAMER™ AFFINITY REAGENTS

Evaldas Katilius[1], Andrew B. Carmel[2], Heidi Koss[1,3], Dan O'Connell[1,4], Breanna C. Smith[1], Glenn M. Sanders[1,5], Greggory S. LaBerge[2,6]
[1]Somalogic, Inc.
[2]Denver Police Department Crime Laboratory
[3]Mackintosh Academy
[4]St. Andrew's School
[5]The Scripps Research Institute
[6]Human Medical Genetics and Genomics Program

A key form of evidence in sexual assault cases are swabs collected from victims or the crime scene which commonly contain mixtures of bodily fluids from a male perpetrator and a female victim. Because these swabs typically contain large numbers of epithelial cells from the victim along with varying amounts of sperm cells from the perpetrator, the separation of sperm containing the perpetrator's DNA from the victim's DNA is crucial in the analysis of evidence for these types of cases. For this reason, to generate a clean DNA profile from the perpetrator, it is usually necessary to first purify sperm cells from the victim's epithelial cells and cell debris. Currently, the most commonly used sperm-isolation protocol employed by forensic laboratories is differential extraction (DE), which relies on the differential lysis of sperm and epithelial cells. Despite its simplicity, the DE process is time-consuming, labor intensive, and can result in unfavorable perpetrator/victim DNA mixtures when sperm cell counts are low. However, due to the widespread use of differential extractions in sexual assault casework, a variety of alternative methods have sought to modify the DE procedure to make it more rapid and effective.

We present an affinity-based sperm cell purification method using SOMAmer™ reagents, DNA-based affinity reagents developed by SomaLogic. Sperm cells were successfully separated from epithelial cells and debris using buccal swabs with added semen on the types of cotton swabs typically used for rape kit evidence collection. The quality of sperm DNA isolated from samples purified using SOMAmers is comparable to existing differential extraction-based methods at higher sperm concentrations. This purification method is simple, offers relatively rapid (< 2hr) sperm purification, and can potentially be automated using robotic workstations. This work was recently published in FSI: Genetics (2018, vol. 35, pg 9-13) and demonstrates the first use of DNA based SOMAmer reagents as affinity ligands to bind sperm cells. With further development, this technique can potentially be used for high-throughput sexual assault forensic casework.