LASER CAPTURE MICRODISSECTION: APPLICATION TO FORENSIC CASEWORK AND EVALUATION AND VALIDATION OF DIFFERENT PLATFORMS

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Laser capture microdissection (LCM) refers to a marriage of existing light microscopic instrumentation to newer technology utilizing pulsed laser beams. Pulsed laser (85-95mV of laser power; 1.2-2ms duration) allows targeting of specific regions of tissues/organs to be separated and placed into snap-cap tubes for DNA extraction and analysis. Thus, LCM can be used to separate specific cell types within whole organs or tissue sections as well as to catapult single cells from a complex tissue source or cellular smear. With LCM, the infrared laser does not alter sample chemistry or morphology. Furthermore, neither the microdissected material nor the surrounding cells are damaged during microdissection. Separations of cells and tissues are necessary in a wide array of research investigations and LCM has rapidly been incorporated into the daily work of research pathologists. Nevertheless, use of LCM in forensics is not yet widely appreciated and promises to answer the heretofore-unmet need for a technology to efficient separation of cells or tissues in forensic mixtures.

Herein we report on our use of LCM in several adjudicated cases involving forensic mixtures. We were successful in the separation of fetal and maternal tissues derived from tissue obtained in felony sexual assault investigations. In the event of pregnancy after alleged sexual assault, paternity determination was performed using abortus material as the evidentiary DNA source. **Microscopic examination allows the distinction of maternal (decidual) vs. fetal (chorionic villi) components of the formalin fixed products of conception (POC).** DNA isolation and amplification of obtained tissue can be performed using standard extraction procedures even if decomposition is present.

We also present results of our collaborative validation studies of the three principal platforms available for LCM from 3 commercial vendors: PixCell Iie Laser Capture Microdissection System (ARCTURUS Systems for Microgenomics, Carlsbad, CA), PALM MicroLaser System, with Laser Microdissection and Pressure Catapulting (LMPC) technology (P.A.L.M. Microlaser Technologies AG, Bernried, Germany) and Molecular Machines & Industries **SL µCUT** system (MMI Molecular Machines & Industries AG, Glattbrugg, Switzerland). While each instrument has distinct differences and advantages, our data document success in DNA extraction and profiling using all three platforms.