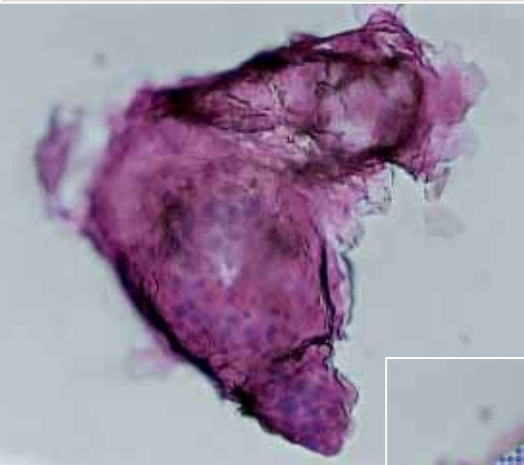


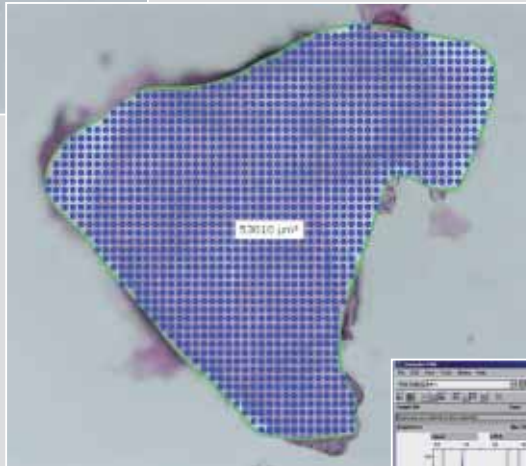
Forensic Medicine

Bridging the Gap between Identification and Contact-free Separation

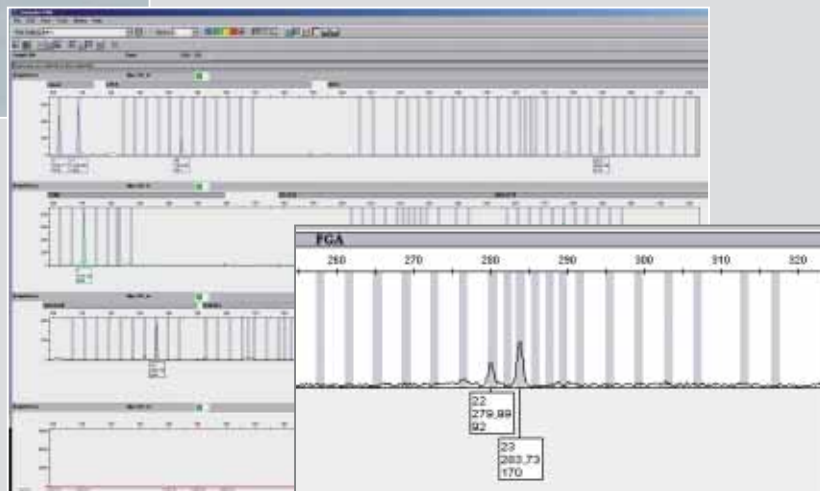


A single dander ...

Forensic evidence at the crime scene often is mixed (contaminated) with cells from the victim or other biological material. With PALM MicroBeam samples can be identified (using microscopy) and separated (using LMPC technology).



... directly isolated from Forensic Adhesive Tape ...



... is enough to get a meaningful DNA fingerprint.

Contact-free Collection of Forensic Evidence with PALM MicroBeam



We make it visible.

Work Directly from Forensic Adhesive Tape

Traditionally, specimen mounting tapes are used to secure forensic evidence. As a new approach we used these tapes for collecting trace material into collection devices completely contact-free. For this approach, there is no need to cut around the selected material. Lifting it up by laser pulses is the only necessary step for successful capture. Samples then are collected into a microfuge tube and are ready to immediately undergo molecular analysis. This way even scarce forensic material like sperm cells or dander can be used for successful analysis.

The PALM MicroBeam offers the unique function to work contact-free directly from Forensic Adhesive Tape without any intermediate steps.

*PALM MicroBeam from Carl Zeiss:
analyzing purest samples*

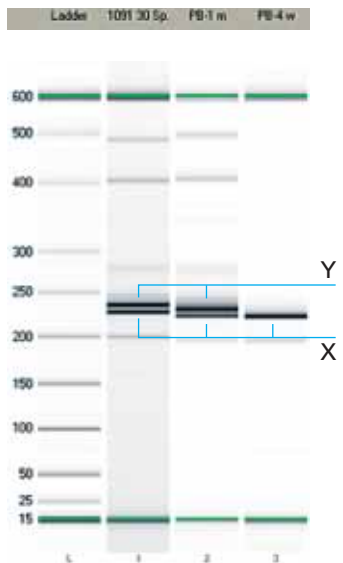


Contact-free Contamination-free How LMPC works

PALM MicroBeam from Carl Zeiss makes contact-free sampling possible. A defined laser pulse transports the selected specimen out of the object plane into a collection device – against gravity. An invaluable innovation for scientific research. And highly beneficial for Forensic Medicine due to unsurpassed levels of precision and purity.



a



Sperm Cells

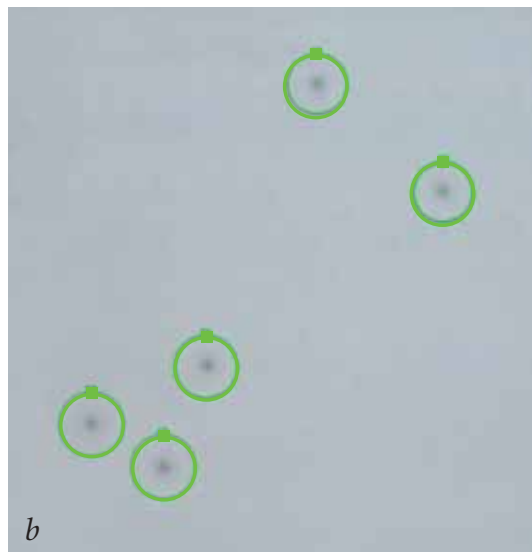
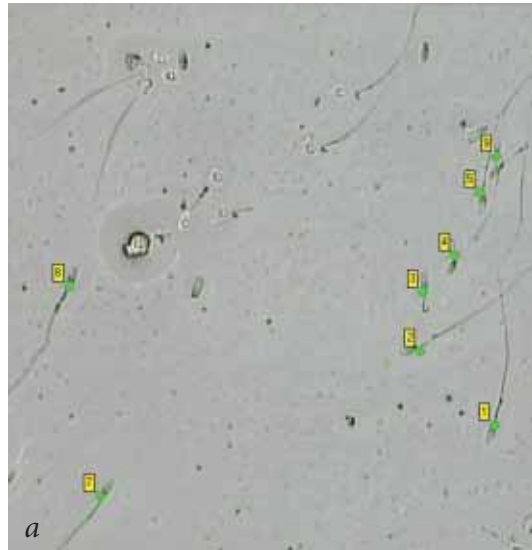
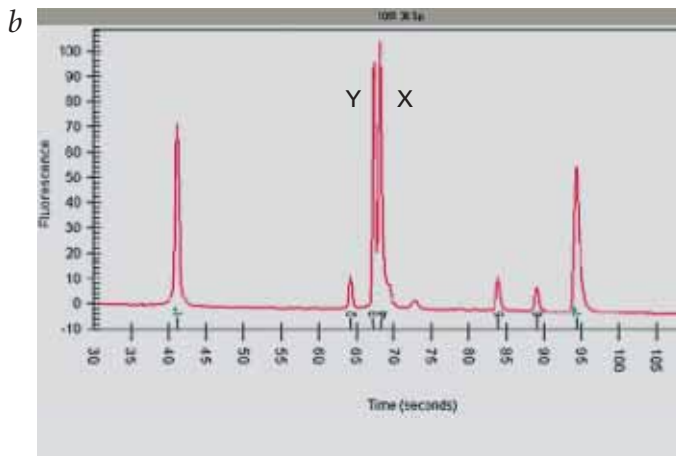
Contamination and scarcity of forensic material often prohibits successful genotyping and conclusive analysis.

Analysis of mixed genotypes is especially difficult when cells of interest are overwhelmed by an excess of unwanted cells. When DNA is copurified from these cells, unspecific background often prohibits successful interpretation of molecular profiles. This difficulty is frequently encountered in evidence with low numbers of spermatozoa or large epithelial/sperm cell ratios. In addition, starting material often is below levels that can be handled by routine DNA purification methods.

PALM MicroBeam can directly dissect and collect pure single cells or cell populations for immediate DNA isolation without the risk of contamination from intermixed adjacent foreign cells. Use of LMPC evades the multistep process required by preferential lysis procedure, which can reduce yield through loss and premature lysis of cells. PALM MicroBeam provides a solution even to archived cases where mixed cellular samples are unresolved or sample analysis was not performed due to an insufficient number of target cells.

DNA isolation from 30 sperm cells

a) Virtual gel band separation, b) Electropherogram



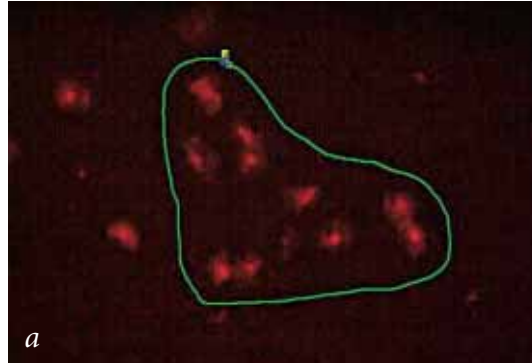
a) Catapulting of single sperm heads into the collection device; cutting before the catapulting process is not necessary. Sperm preparation on routine glass slide.

b) Check of catapulting process. View into the collection device (AdhesiveCap). Collected single sperm heads marked by circles.

Epithelial Cells

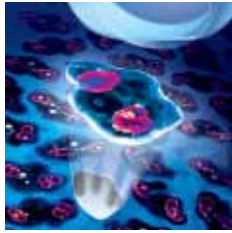
Identification of spermatozoa is the primary evidence for the examination of sexual assault cases. Absence of spermatozoa, however, is no reason to terminate biological investigations, if Y chromosome specific positive cells can be found.

In sexual assault cases, swabs are routinely taken and submitted for molecular analysis. Even in the absence of sperm cells (e.g. in the case of azoospermia), other cells derived from the suspect may still be detected. Due to the extensive number of epithelial cells originated from the victim just lysis of the cells on the swab presumably results only in the victim's DNA profile. However, combining FISH labeling of X and Y chromosomes and subsequent isolation of the XY-marked cells by LMPC will allow for getting successful molecular profiles from male cells.



- a) Y chromosome specific fluorescently marked epithelial cells.
- b) Marked epithelial cells in brightfield.
- c) After cutting.
- d) After catapulting.

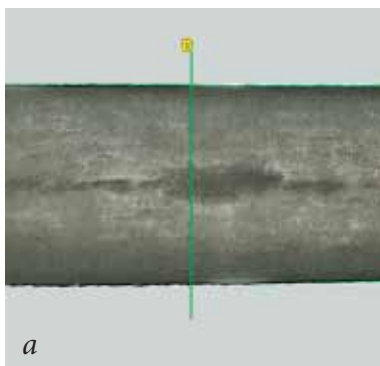
Examples



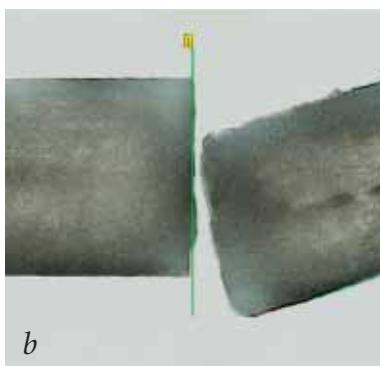
Hair

Microscopic examination of hair structure, measurement of hair thickness and contact-free cutting of the hair are possible applications.

With PALM MicroBeam a fully equipped research microscope is combined with a microdissection system. This allows examination of hair structure as well as measurement of hair thickness as forensic indicators. Catagenic and telogenic hair mostly don't show adherence of sufficient body cells. They only possess heavily degraded human DNA in their roots. Only by applying most sophisticated techniques some telogenic hairs can be used for DNA profiling, albeit for very short DNA loci. In such cases LMPC can be used to collect the sparse relevant cells safely and conveniently for subsequent analysis.



*a) Single hair. Measurement tools integrated in PALM RoboSoftware.
b) Cutting of the hair by the laser (contact free, one single cut).
Result: Two clearly separated pieces of the hair.*



*a) Single hair showing two adhesions.
b) Laser marker (two single dots in white) showing location of later laser action.
c) and d) Hair after catapulting of adhesions.*



The new generation of PALM MicroBeam



*Dr. Jindrich Novotny,
State Office of Criminal Investigation,
Munich, Germany*



*Prof. Dr. Stephan Seidl,
Institute of Legal Medicine,
University Erlangen-Nuremberg, Germany*

“We were the first group in Germany to use PALM MicroBeam for forensic sample collection. In the PALM Application Laboratory, we processed smear preparations from vaginal, sperm, and buccal cell swabs for downstream DNA profiling. Contact-free microscopic isolation and collection of single cells revealed to be the perfect process for sampling and analysis of these trace materials. As the PALM technology prevents sample contamination it is especially suited for forensic purposes.”

“We are using DNA-typing of classical stains like blood, saliva, sperm as well as hair and other type of traces, saved from crime scenes. We are developing novel techniques for isolation and analysis of even minute biological traces for proof at heavy delicts in the future. For this purpose we are using PALM MicroBeam technology to select and isolate cells for downstream analyses. This way we performed a DNA profiling study by STR analysis and got donor specific profiles even from minute amounts of material.”

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