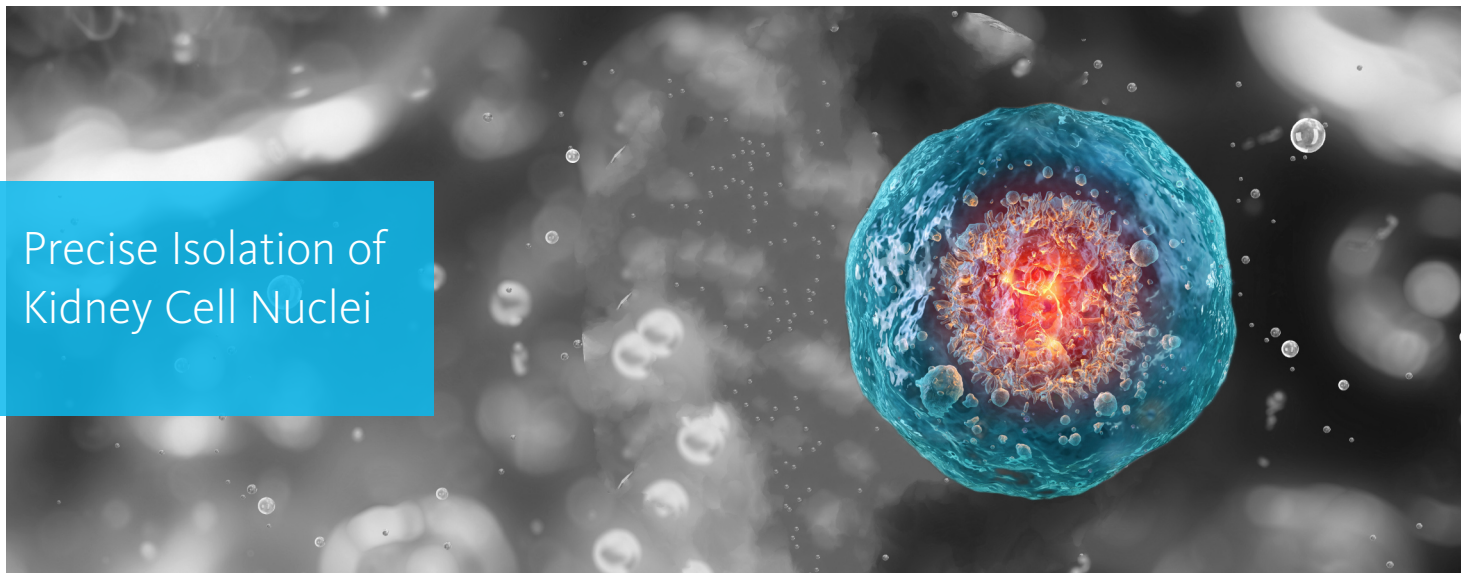
Technical Note

Subcellular Compartment Isolation Using the MMI CellCut Laser Microdissection System



Precise Isolation of Kidney Cell Nuclei

Jun Zhang[1], Martin Breitkreuz[1]

[1]Molecular Machines & Industries GmbH, Eching, Germany

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Abstract

The MMI CellCut system enables precise and contamination-free isolation of tissue, cells, and even subcellular compartments. In this note, we show the excision of individual nuclei from FFPE kidney sections (H&E stained). The results demonstrate the system's capability to provide highly specific material for downstream analysis.

Introduction

Laser Microdissection (LMD) has become an indispensable tool in modern biomedical research, as it enables the precise isolation of defined regions of interest (ROI) from complex tissue samples. By providing uncontaminated material for downstream molecular analysis, LMD overcomes the limitations of heterogeneous samples where signals from mixed cell populations can obscure relevant biological information.

The MMI CellCut system offers distinct advantages in this context. With a laser cutting edge as fine as 0.3 µm, it is the most precise and gentle LMD system available on the market today. This level of accuracy enables the reliable isolation of even the smallest structures without affecting adjacent tissue. The patented CapLift collection technology achieves the highest collection efficiency, up to 100%, ensuring that dissected material is directly transferred to and secured on an adhesive cap. This provides full visual control throughout the process while minimizing sample loss and contamination.

While LMD is widely used to isolate single-cell populations, the ability to dissect subcellular structures—such as nuclei or organelles—provides an even higher level of resolution. By comparing single-cell versus subcellular isolation, researchers can investigate localized gene expression, protein distribution, or epigenetic modifications within individual compartments, allowing a more detailed understanding of cellular function.

In this technical note, we demonstrate the capability of the MMI CellCut system to excise and collect subcellular structures from human kidney tissue. The material analyzed consisted of 3 µm sections of FFPE kidney tissue, H&E stained and mounted on MMI Membrane Slides. Individual nuclei were successfully identified, dissected, and collected, highlighting the system's unmatched precision and versatility in subcellular microdissection.

Materials and Methods

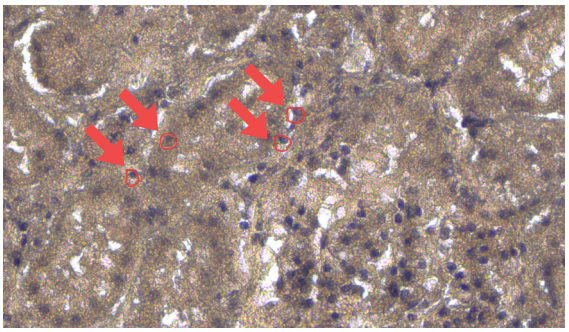
- Kidney tissue sections, 3 µm thick, formalin-fixed, paraffin-embedded (FFPE), Hematoxylin & Eosin (H&E) stained
- MMI CellCut Laser Microdissection System
- MMI Membrane Slides [50103]
- 0.5 ml IsolationCaps [50202]

The kidney tissue sections were already prepared, H&E stained, and mounted on MMI Membrane Slides prior to the experiment. Using the MMI CellCut system at 40x magnification, individual nuclei were identified under the microscope and precisely excised with the laser. The dissected nuclei were collected onto 0.5 ml IsolationCaps, and the collection was subsequently inspected to confirm successful isolation.

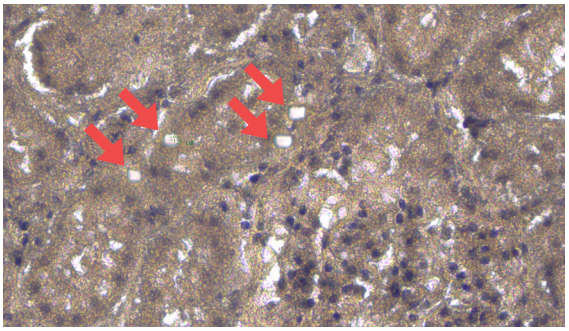
Results

Nuclei in the kidney tissue were first identified and marked for dissection (Fig. 1a). The marked nuclei were then carefully excised using the CellCut laser (Fig. 1b). Collection efficiency was subsequently evaluated by the visual inspection tool. The diameter of the collected nuclei ranged from 4.3 to 5.4 µm (Fig. 1c).

a)



b)



c)

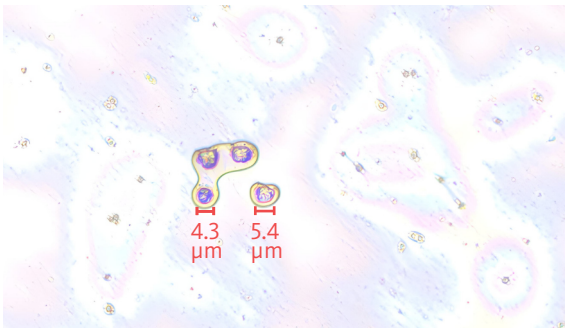


Fig. 1: Kidney tissue, FFPE, 3 µm, H&E stained, 40x magnification. **a)** Individual nuclei were marked for dissection using the MMI CellCut. Arrows indicate the positions of the four marked nuclei. **b)** Excised nuclei within the tissue. Arrows indicate the positions of the nuclei that were removed. **c)** Visual inspection of the isolated nuclei on the IsolationCap. All four nuclei were successfully recovered. The diameters of two nuclei are indicated: 4.3 µm and 5.4 µm.

Conclusion

The MMI CellCut Laser Microdissection system combines exceptional precision with gentle, contamination-free isolation, enabling the collection of single cells as well as subcellular structures such as nuclei. This technical note demonstrates that even these small compartments can be accurately isolated, making the system a powerful tool for studying tissue and cellular heterogeneity at the subcellular level.

Manufacturer: Molecular Machines & Industries Germany | Switzerland | China | USA
Breslauer Strasse 2, 85386 Eching, Germany • Phone (Germany): +49 89 319 048 40 • Phone (USA): +1 331 307 0273
Email: info@molecular-machines.com • **www.molecular-machines.com**