

Microfluidic Biopsy Holder: Enabling Long-Term Biopsy Studies

by Axel Hochstetter — Life on a Chip & Zosia Komar — ErasmusMC

15-10-24

Introduction

Being able to observe a biopsy for days or even weeks with confocal precision, while keeping them in a steady environment that allows for cells to grow is a step change in cancer research and immunology. When considering the needs of the cells for constant exchange of medium while keeping them in the same focal plane a stable positioning of the biopsy is both critical and challenging. The Microfluidic Biopsy Holder MK3 enables long-term biopsy viability through continuous perfusion, allowing for real-time observation (e.g. confocal fluorescence microscopy) and polyomic analysis (metabolomics and proteomics). Designed for ease of use and precision, it fits standard microscopy holders (25 mm x 75 mm) and can be adapted for various biopsy shapes and sizes.

Application Examples

- **Cancer Research:** Study tumor biopsies over extended periods.
- **Polyomics Studies:** Collect biochemical data while keeping the sample perfused.
- **Drug Testing:** Observe biopsy reactions to drugs
- **Cell-Cell-Interaction:** Determine how T-cells, B-cells, etc. interact with different cell types in your biopsy.

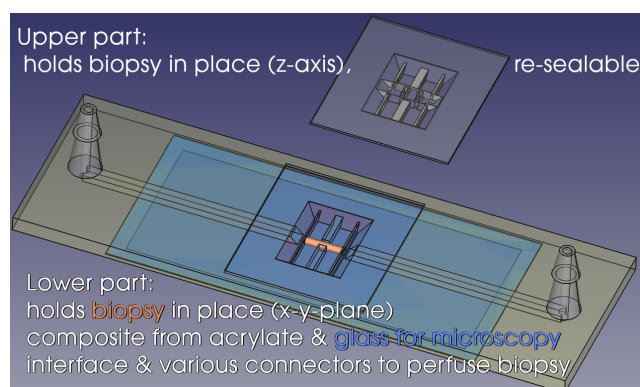


Figure 1: Schematic of the Biopsy Holder Mk3

Specifications

- **Microscopy Compatibility:** Fits standard microscopy slides (25 x 75 mm²). Plate-reader compatible options available.
- **High Transparency:** Optimized for fluorescence, confocal, and Raman microscopy.
- **Easy (re-)sealing:** Allowing you to retrieve and e.g. (re-)stain the biopsy, and re-use the holder.
- **Custom Connection:** Various connectors (e.g. luer-lock, tubing cones, etc...) can be built into the holder for seamless integration.
- **Material Quality:** Plant-based acrylate, for high-end applications, a parylene coating is possible to completely shield your sample.
- **Fits your biopsies:** Supports and securely holds biopsies of 5 mm length and 1 mm diameter. Different size? Just contact us!



Materials and Methods

This section covers the materials and practical steps for preparing biopsies using the Microfluidic Biopsy Holder for long-term studies. We assume you already have access to essential lab equipment like pumps, tubing, connectors, and an incubator, and that you're comfortable using them.

For best results, follow standard Good Laboratory Practice (GLP) guidelines throughout the process. If you're new to working with this type of equipment or method, don't hesitate to reach out for support.

Materials

- Microfluidic Biopsy Holder
- Cell culture medium (DMEM, RPMI, or as required)
- Luer-lock compatible tubing
- Disinfection solution (e.g., 70% ethanol or IPA)
- Perfusion system or syringe pump

Standard Operating Procedure (SOP)

Step 1: Initial Setup

- Clean all surfaces with 70% ethanol or IPA.
- Prepare your microfluidic pumps, tubes and connectors.
- Load the Lower Part into the stage of your running microscope.

Step 2: Loading the Biopsy

- Place the biopsy in the lower part of the holder.
- Optional: place a tiny amount of medium on the biopsy to ensure cell viability.
- Click the upper part into place and secure it using the pre-cut adhesive foil.

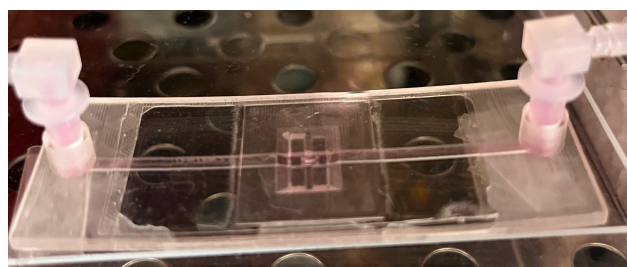


Figure 2: Biopsy Holder with luer-lock in action



- Use the Life on a Chip scraper to ensure the foil is properly sealed.
- Let the foil bond for at least 10 minutes

Step 3: Connecting to Perfusion System

- Attach sterile Luer-lock tubing to the inlet and outlet.
- **Tip:** Having a hanging drop of liquid before fitting the connector or tube into the device might avoid bubble formation.
- Set a flow rate of 10-50 $\mu\text{L}/\text{min}$ for continuous perfusion.

Conclusion

The Microfluidic Biopsy Holder offers a solution for extended biopsy studies, enabling real-time imaging and comprehensive analysis, while keeping the cells alive. Its adaptability and ease of use make it ideal for various research applications.