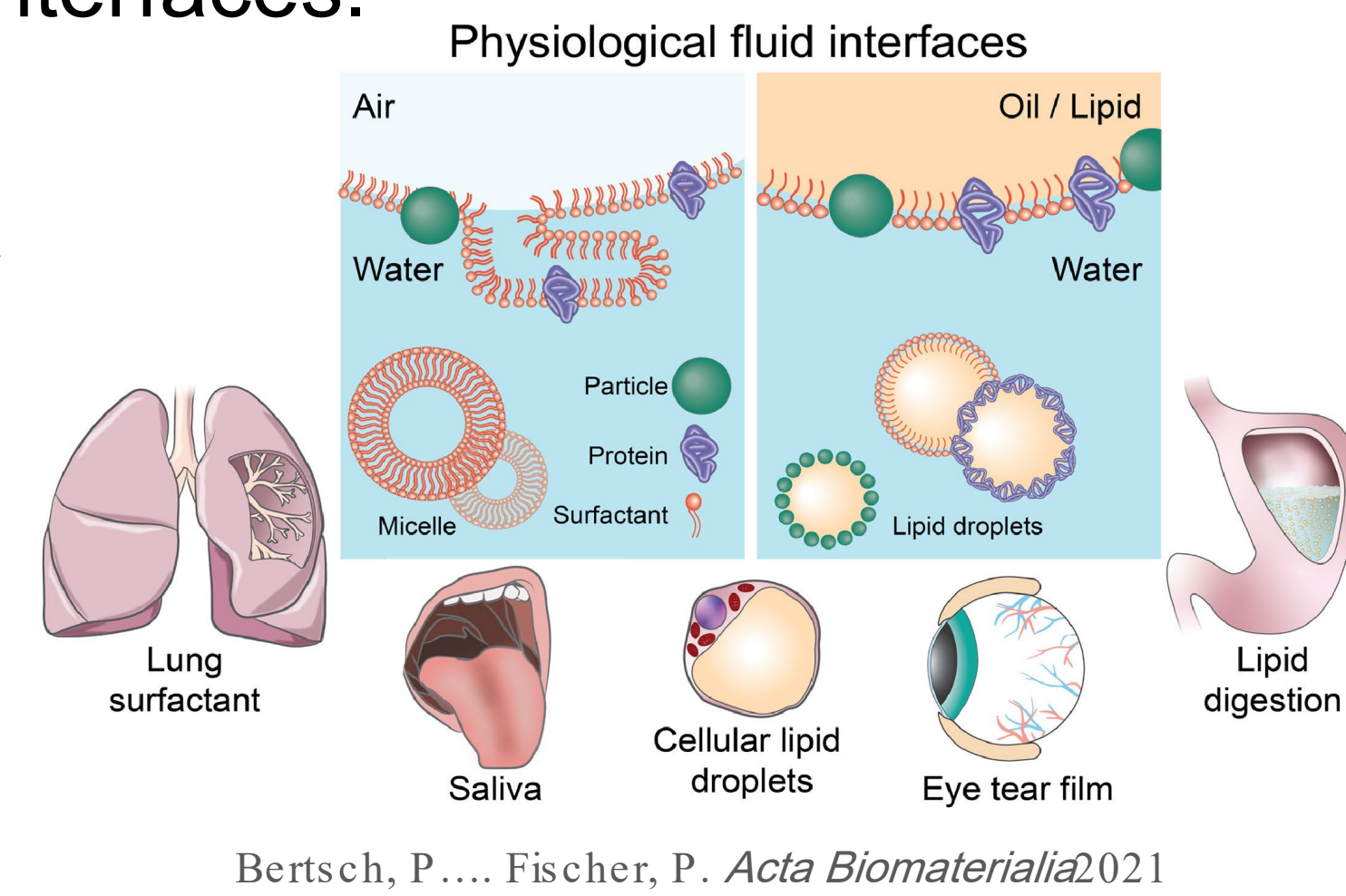


## Objective

To fabricate a microfluidic device capable of a stable liquid-to-liquid interface to analyze bacterial adhesion within the liquids during laminar flow.

## Background

- Bacterial growth and attachment at liquid-liquid interfaces have yet to be analyzed due to the difficulty is optically assessing these interfaces.
- Studying bacteria's biomechanical attachment to liquid-liquid interfaces can help elucidate the role of biofilms in membrane fouling, food spoilage, nosocomial infections, and bioremediation.



## Methods

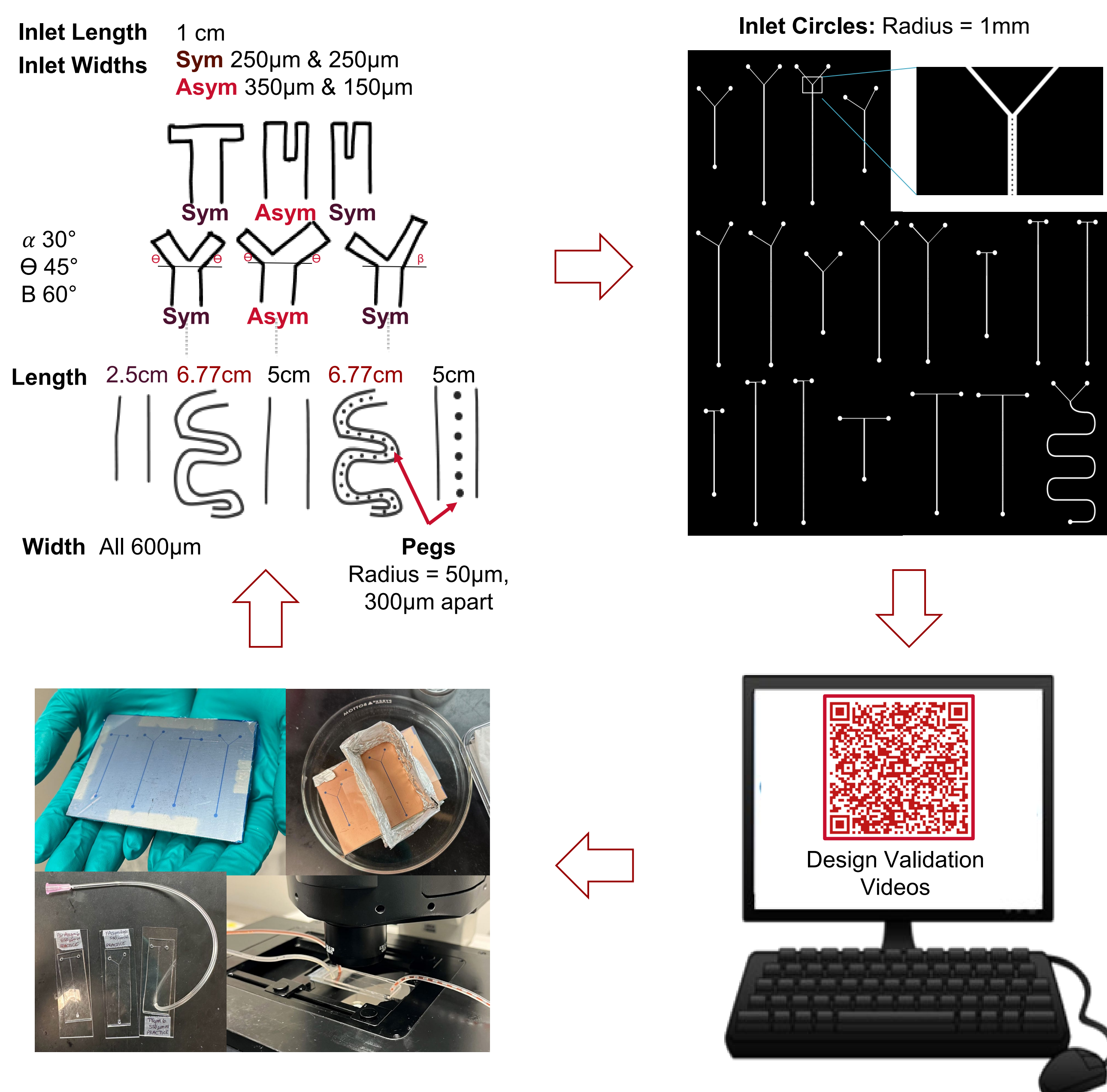
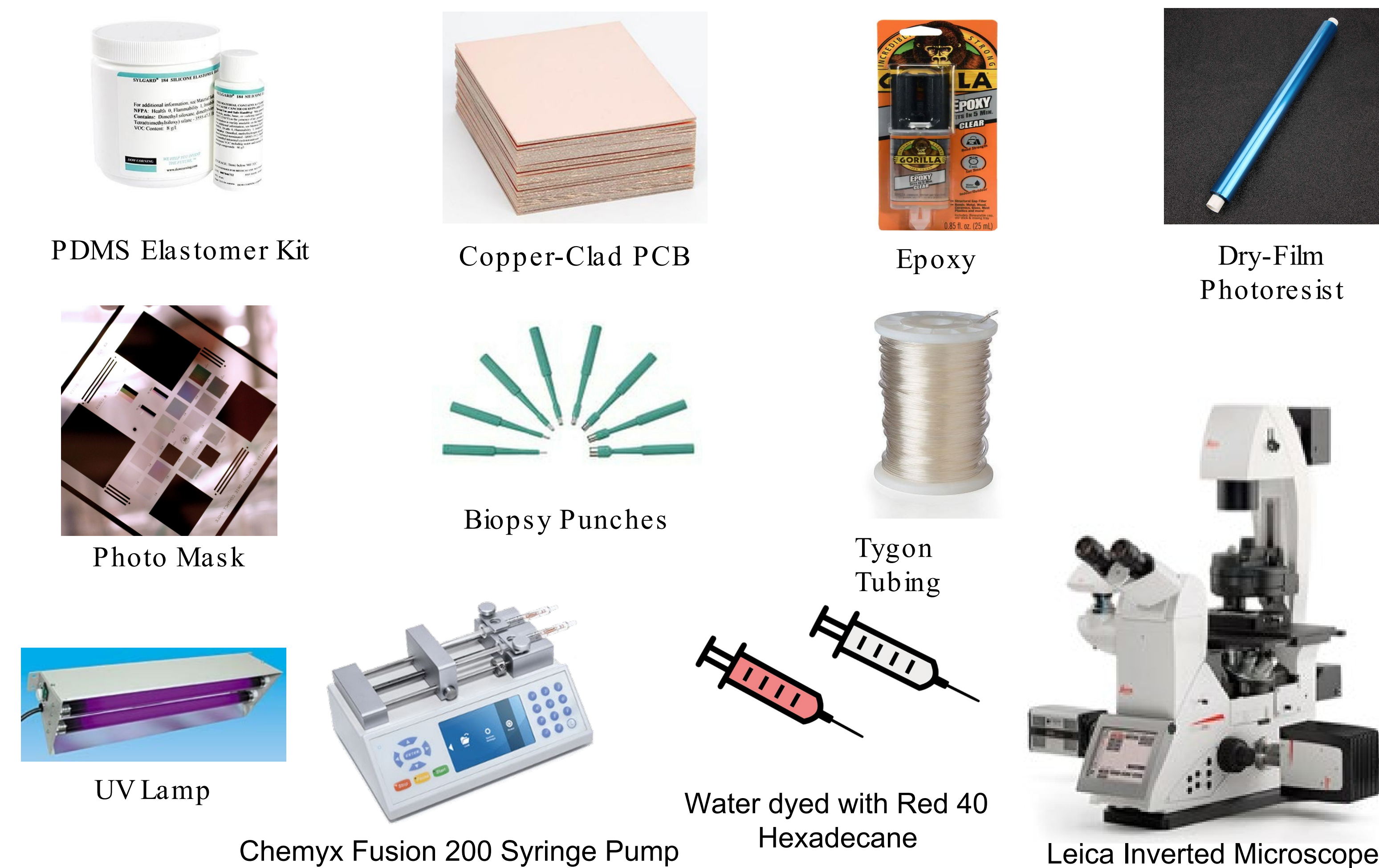


Figure 1. General system workflow - brainstorm, design, test, fabricate.

## Materials



## Results - PDMS Devices

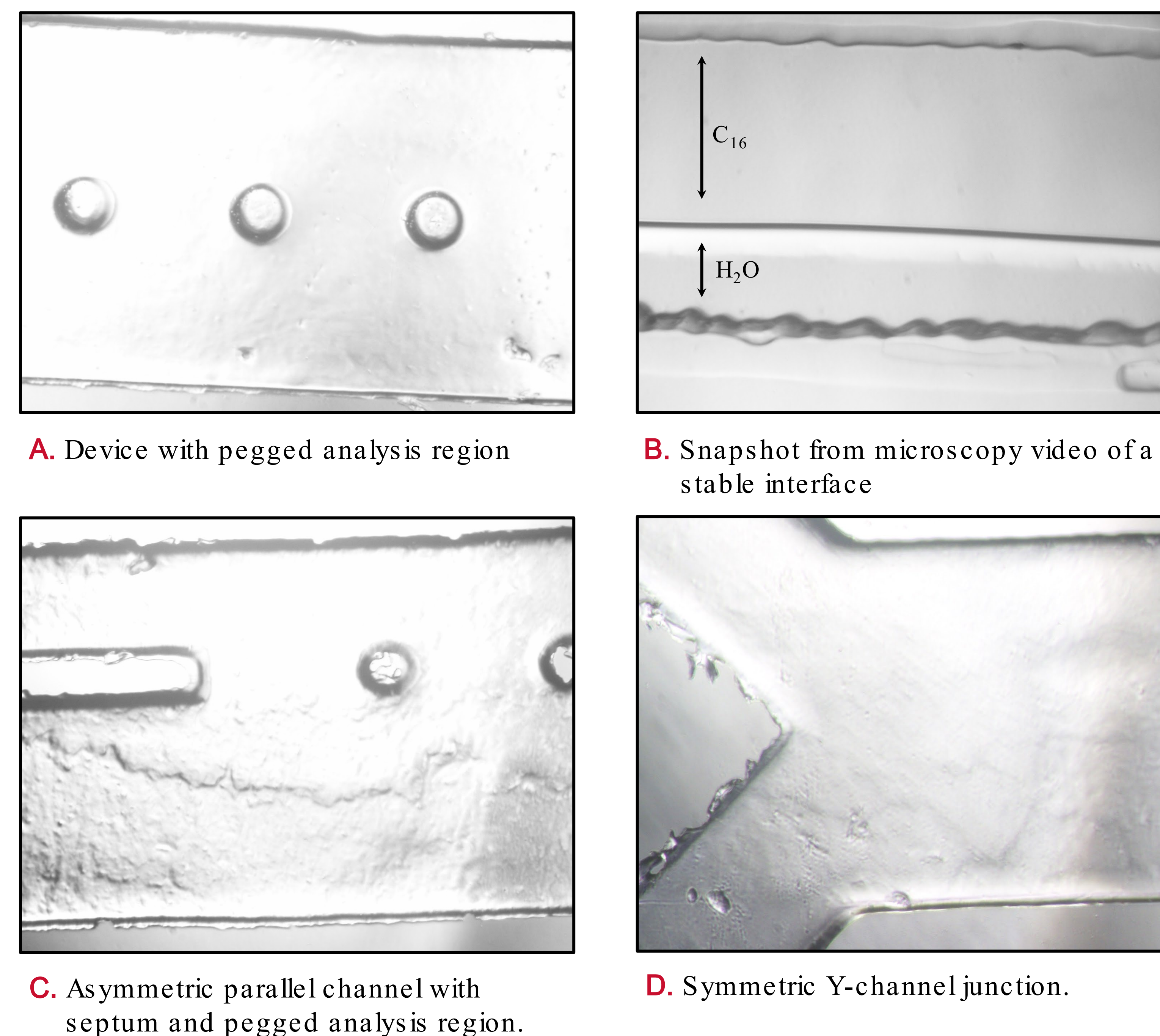


Figure 2. Microscopy imaging of PDMS fabricated devices.

## Results - COMSOL

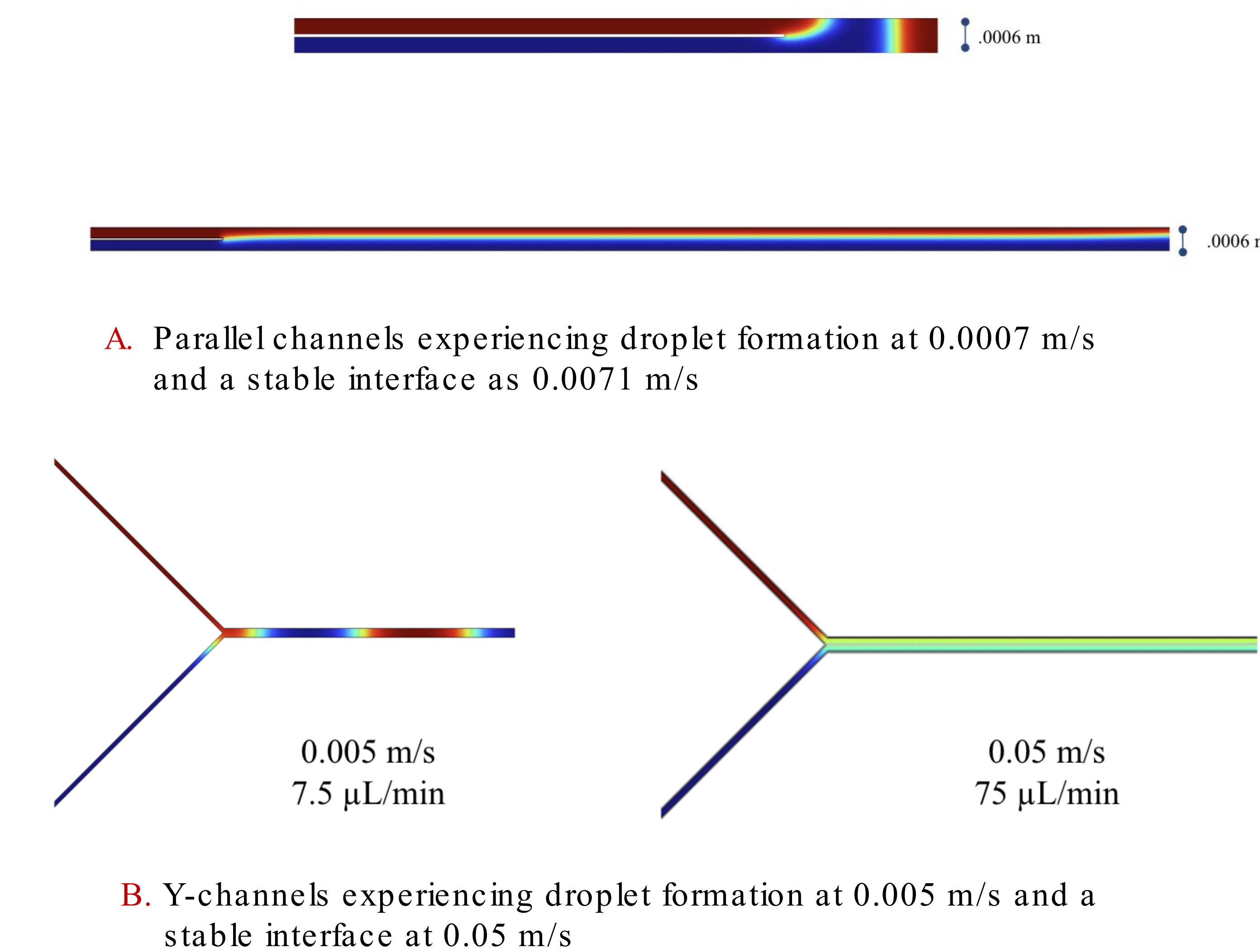


Figure 3. COMSOL simulations of devices

## Conclusion

- We built microfluidic devices that maintain stable liquid-liquid interfaces for observing bacterial adhesion.
- These devices achieve stable interfaces at flow rates as low as 7  $\mu$ L/s in COMSOL simulations.
- Currently, our devices require mobile liquids. Future work aims to stabilize static interfaces.

Future studies will focus on three areas:

- The effect of surfactants, detergents, and salts on interfacial stability
- Interfaces between miscible liquids
- The role of bacterial appendages in adhesion

## Acknowledgement

We would like to acknowledge Dr. Jacinta Conrad and her PhD student Udayanidhi Ramesh Kumar for their support in developing this project as well as the National Science Foundation (Grant ID: DMR-2104796).