

Microfluidic droplet generator for lymph node microphysiological models

Progress Report 4

Date: September 25, 2026 - October 1, 2026

Client: Dr. Cristina Sanchez de Diego

Advisor: Prof. Monica Ohnsorg

Team:

Co-Team Leader: Sam Kamin (sjkamin@wisc.edu)

Co-Team Leader: Murphy Diggins (mdiggins@wisc.edu)

BSAC: Will McGuire (wjmcguire@wisc.edu)

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Project Website: [Link](#)

Problem Statement: Prostate cancer (PCa) commonly metastasizes through the lymphatic system. Understanding how cancer cells spread through lymph nodes is therefore critical to developing therapies that can prevent or limit metastasis. However, current lymph node models primarily represent tissue in two dimensions and cannot fully replicate its complex three-dimensional structure and cellular interactions. This project aims to fabricate a microfluidic droplet device capable of producing B- and T-cell-containing collagen microspheres, which will serve as building blocks for a realistic 3D lymph node model to more accurately study cancer metastasis.

Brief status update: Our team has prototyped multiple different chip designs for flow and collagen testing. We've also begun fabricating cooling mechanisms and set up the device with the syringe pump.

Current design: SolidWorks Mask Design

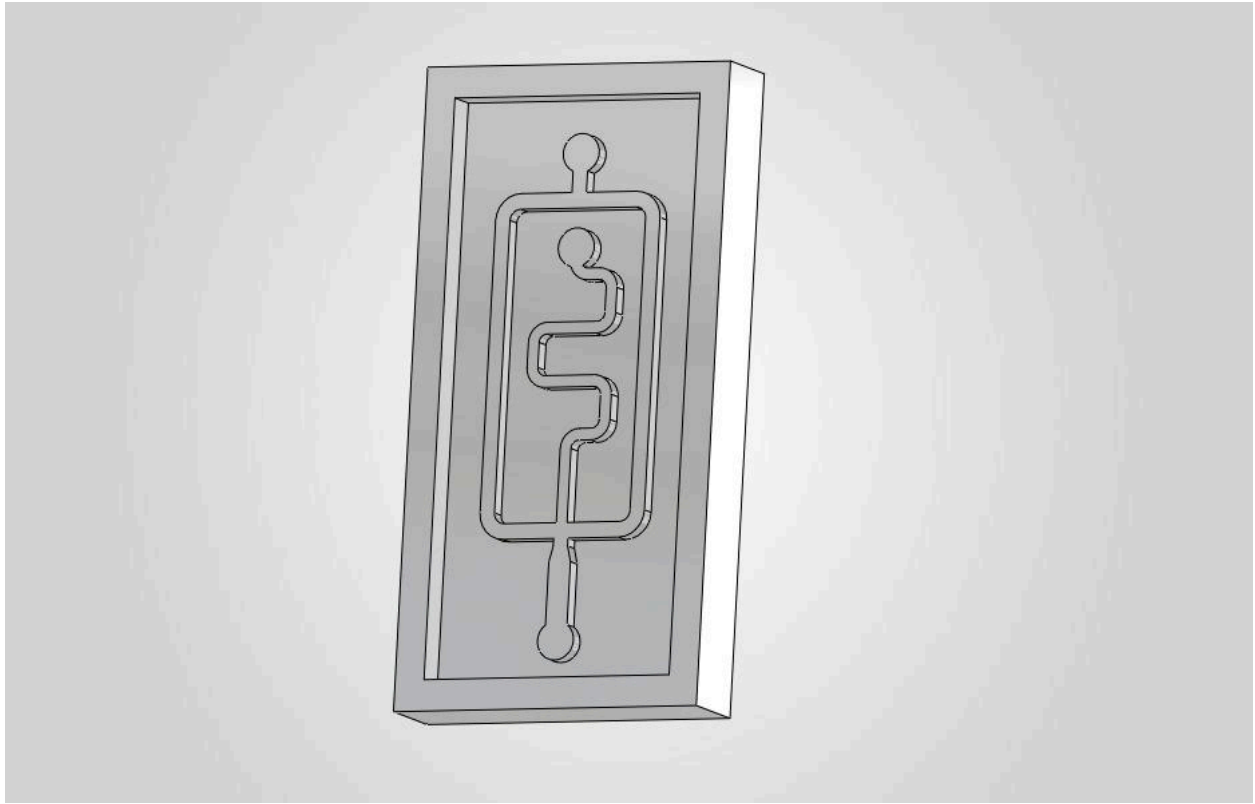


Figure 1: Current Microfluidic CAD design for 0.5uL Droplets



Figure 2: Assembled Microfluidic Device

Previous Week's Accomplishments

- Sam Kamin (3 hours)
 - Worked on the preliminary presentation
 - Researched more competing designs or competing system solutions
 - Researched syringe pumps and instrumentation
- Murphy Diggins (3 hours)
 - Edited collagen cooling design
 - Learned how to assemble the device and began using the syringe pump
 - Printed elastic resin ice cube mold (it turned out nicely)
- Will McGuire (4 hours)
 - Researched collagen polymerization and glycerol/water solution for cooling
 - Conducted prototype testing at the worm lab to determine the durability and effectiveness of the microchip design including a glycerol/water cooling channel
 - Cad design on an additional glycerol/water channel chip idea
 - Planning for next steps regarding design integration
 - Worked on preliminary presentation

- Dylan Libel (4 hours)
 - Visited WIMR and set up the syringe pumps they have
 - Ran liquid through the PDMS chips we have, working with Murphy, Christina, and others to best connect tubing to the chips and optimize chip design
 - Helped set up the 3D resin printers to enable prototyping within the lab
 - Worked on the Preliminary Presentation sections
- Eduardo Usandivaras (4 hours)
 - Researched more into how to cool the device and how to utilize different flow rates with different materials
 - Conducted time-trial experiments with collagen samples to test how quickly it polymerizes at room temperature, and how it would affect the flow of our device.
 - Communicated with the client regarding the date, time and location of our presentation.
- Vir Jaiswal (3 hours)
 - Visited WIMR and tested out the syringe pumps before thinking about the appropriate flow rate required for the collagen.
 - Checked the polymerization of collagen at different temperatures.
 - Learned and researched the problems with our mechanisms.

Team Goals

- Complete fabrication of cooling methods and begin implementation into the design.
- Order necessary materials needed for running the prototype
- Begin collagen testing on the device and measure collagen bead sizes.
- Edit PDS based on comments.
- Complete Preliminary Report

Individual Goals

- Sam Kamin
 - Complete the preliminary report
 - Edit the PDS document and design matrices with the feedback from Dr. Ohnsorg
 - Continue researching
 - Continue prototyping
- Murphy Diggins
 - Contribute to preliminary report
 - Begin testing device with collagen and oil (time permitting)
- Will McGuire
 - Complete the preliminary report
 - Continue research
 - Test device with collagen
 - Prototype water/glycerol cooling channel chip
- Dylan Libel
 - Work on the preliminary report, fleshing out sections

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Project Timeline

[illegible]

[illegible]