

Microfluidic droplet generator for lymph node microphysiological models

Progress Report 1

Date: September 2, 2026 - September 10, 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 (wjm McGuire@wisc.edu)

BWIG: Dylan Libel (libel@wisc.edu)

Communicator: Eduardo Usandivaras (usandivaras@wisc.edu)

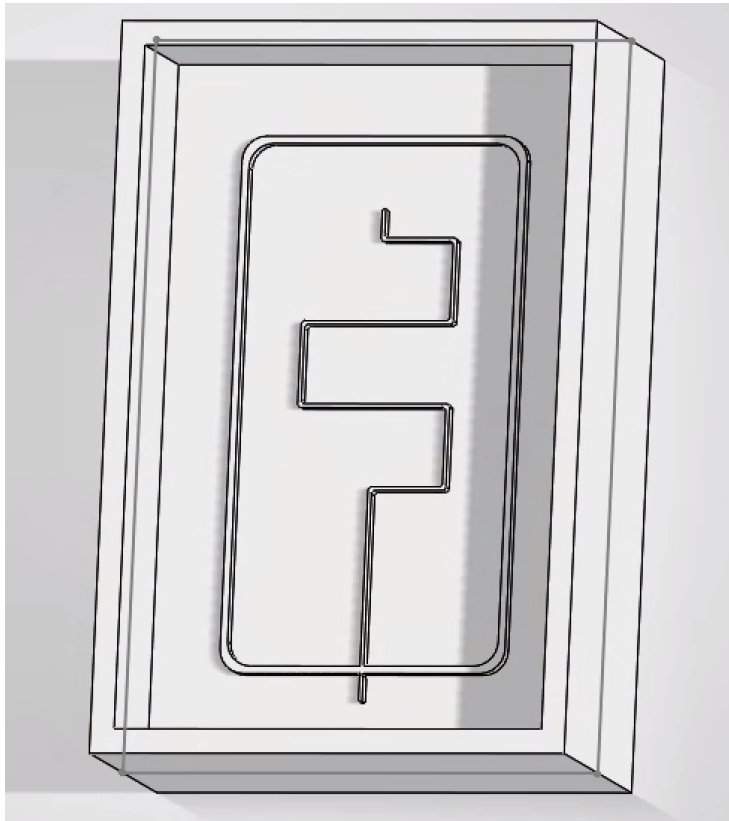
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Project Website: [Link](#)

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 is currently narrowing down the project specifics to ensure our client's needs are accurately met. We're prototyping a generic device and researching existing microfluidic devices to better understand how to tackle this project.

Current design: SolidWorks Mask Design



Previous Week's Accomplishments

- Sam Kamin (4 hours)
 - Researching microfluidics in general to understand the field
 - Researching the work being done by Dr. Sanchez de Diego
 - Visited lab at WIMR with the team to meet the client and learn about the project scope and resources available to us
- Murphy Diggins (2.5 hours)
 - Researching existing droplet generators to gain an understanding of how to make a device.
 - Created a SolidWorks design for an initial mold, hoping to have a PDMS prototype ready to start figuring out flow logistics
- Will McGuire (3 hours)
 - Researched alternative methods to create microfluidic droplet generators to the chip
 - Researched the ways in which micropillars can increase structural integrity and optimize throughput
 - Looked into Spinning Conical Frustum techniques to produce microdroplets without microfabrication - this seemed to be unachievable considering the amount of fabrication required on a macro scale
 - Researched parallel channel systems of droplet generation that will increase throughput without changing the method of droplet generation
 - Visited the WIMR lab and met our client, Dr. Sanchez de Diego
 - Started to grasp the fundamentals of why our droplets will aid our client in her lymph node research
 - Toured the lab seeing the important machinery and devices we will be using, looked at the PDMS station, and got to see our group's lab bench.
- Dylan Libel (2 hours)
 - Researching droplet generators and the procedures used by Dr. Sanchez de Diego
 - Went and visited the lab at WIMR with the team to better understand our project and the resources available to us
 - Working to install ComSol and start fluid dynamics simulations
- Eduardo Usandivaras (2 hours)
 - Reviewed the task presented to us by Dr. Sanchez de Diego, researched NIH publications on related studies about how to use collagen droplets for organoids and microfluidic fundamentals
 - Visited the lab at WIMR with the team and our client to get an overview of our project details
 - Communicated with Dr. Sanchez de Diego regarding getting a brief lab orientation to properly use the equipment
- Vir Jaiswal (2 hours)
 - Read articles about preexisting models of a microfluidic droplet generator and about the lymph node structure and requirement of collagen.
 - Visited the WIMR with the team and met up with the client
 - Sent my availability to establish future meet up times.

Team Goals

- Form concrete grasp of project scope and biological background through correspondence with advisor Dr. Ohnsorg and client Dr. Sanchez de Diego
- Research and discuss design ideas for droplet generator
- Get group training in lab and complete all lab safety requirements to use the required equipment
- Prototype first generic droplet chip using 3D modeled design

Individual Goals

- Sam Kamin
 - Go back to WIMR for trainings on the various tools available for us throughout the design process
 - Continue researching the project scope and biological background
 - Begin researching droplet generators and the components necessary
 - Work on PDS
 - Initial design ideas
- Murphy Diggins
 - Fabricate a generic microfluidic device
 - Research materials and experiment with COMSOL
 - WIMR visit for orientation
- Will McGuire
 - Gain a better understanding of how our microfluidic droplet generator will aid Dr. Sanchez de Diego in her research and why a small droplet size is so vital
 - Learn how to use the resin printer during laboratory time
 - Continue research on droplet generators.
 - Generate initial design ideas
- Dylan Libel
 - Get ComSol up and working
 - Go back to WIMR for resin and 3D printing trainings
 - Continue to research and get a better understanding of what the goal and steps of our project are
 - Start work on PDS
- Eduardo Usandivaras
 - Research Microfluidics basics and solutions for our project
 - Establish meeting times with client and group for lab work and orientation
- Vir Jaiswal
 - Research a bit more about the properties of collagen and problems related to that
 - Learn and acquire training for the equipment that we'll have to operate
 - Research preexisting models to use as a point of reference for our project

Project Timeline

[illegible]

[illegible]