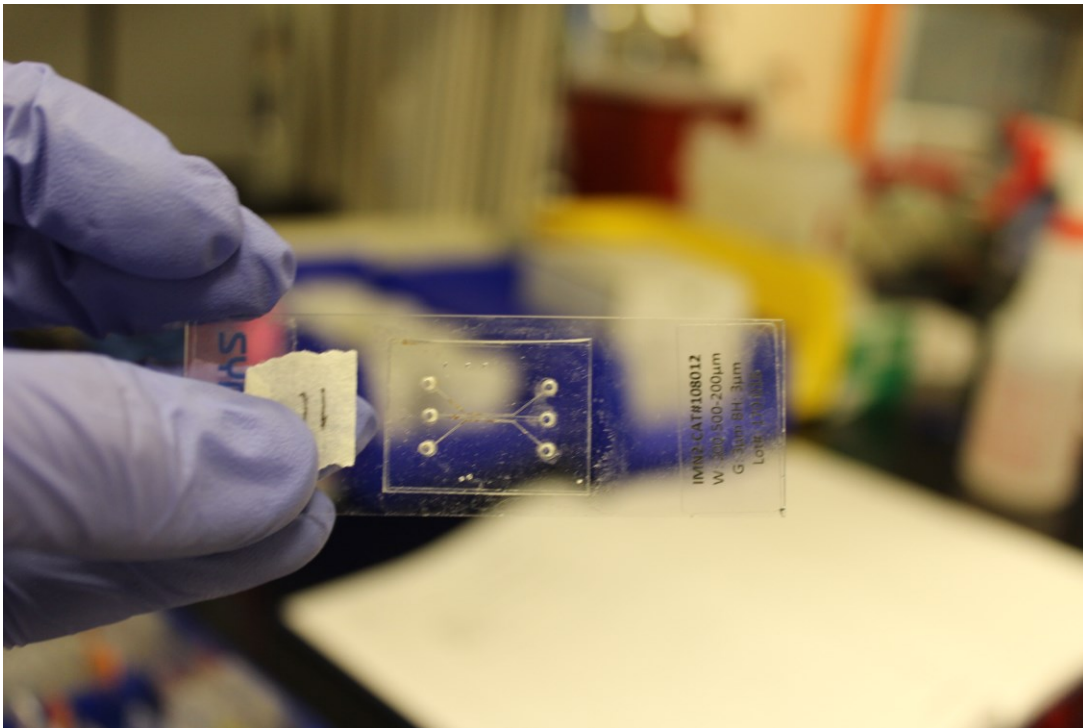# Science Influencers Lab Work Summary

Davis Johnson

Summer of 2024
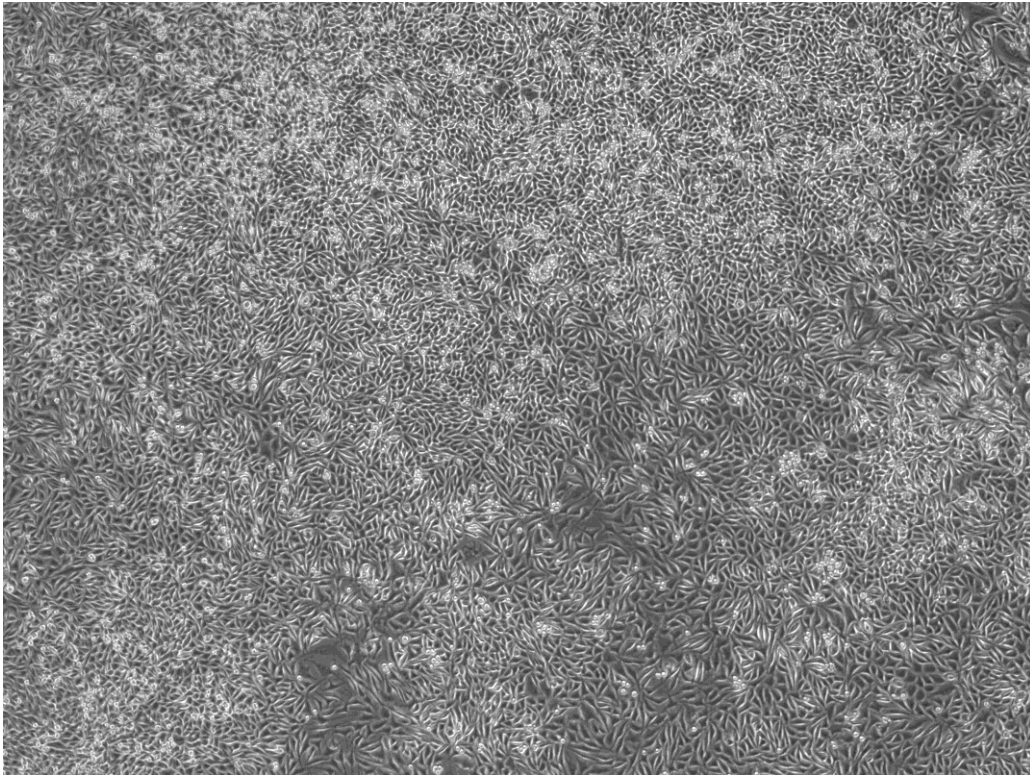
What is microfluidics?

- Microfluidics is a way of modeling bodily functions in vitro, or outside the body.
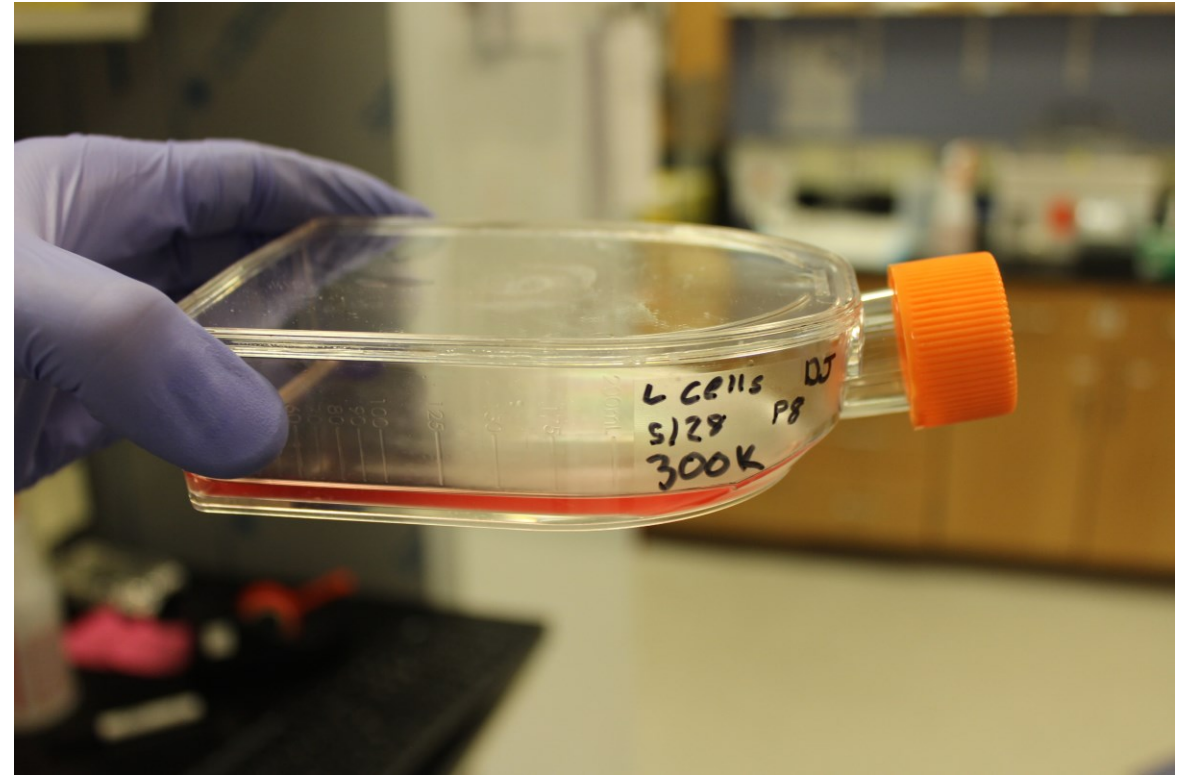
First Time Lab Experience

- This was a huge learning curve
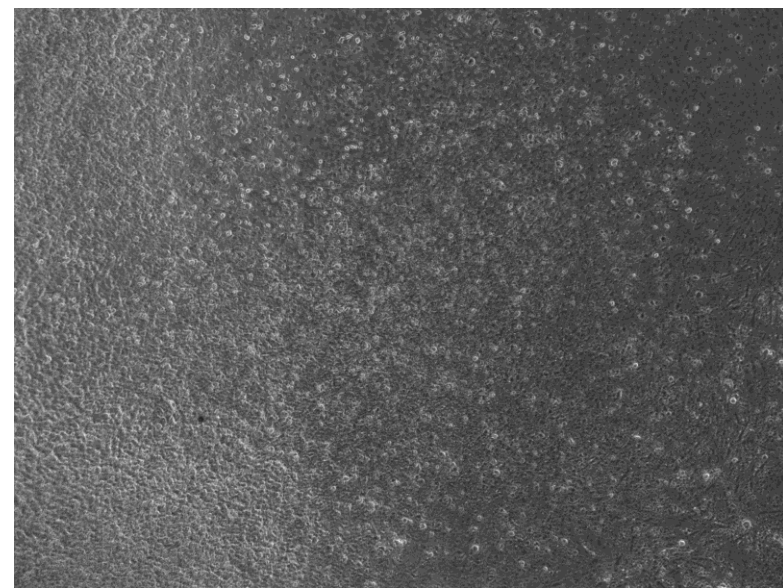- Procedures
- Cell types + mediums
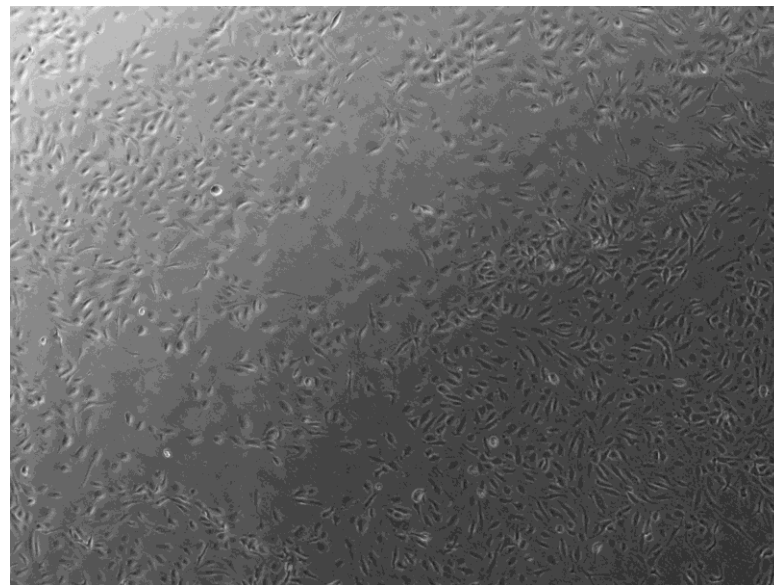- Morphology

L cells after 10 days of culturing
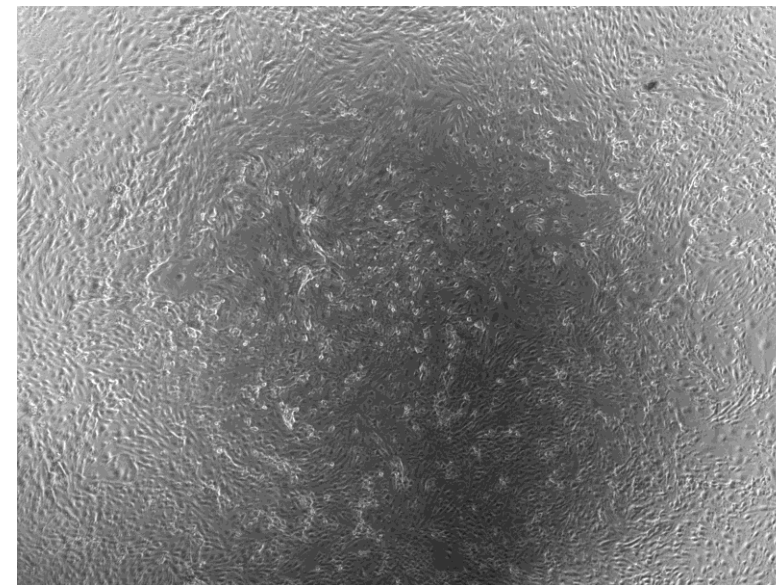

My first ever cell culture!

Various Cell Cultures

HMG

HRE

MRE

ARPE
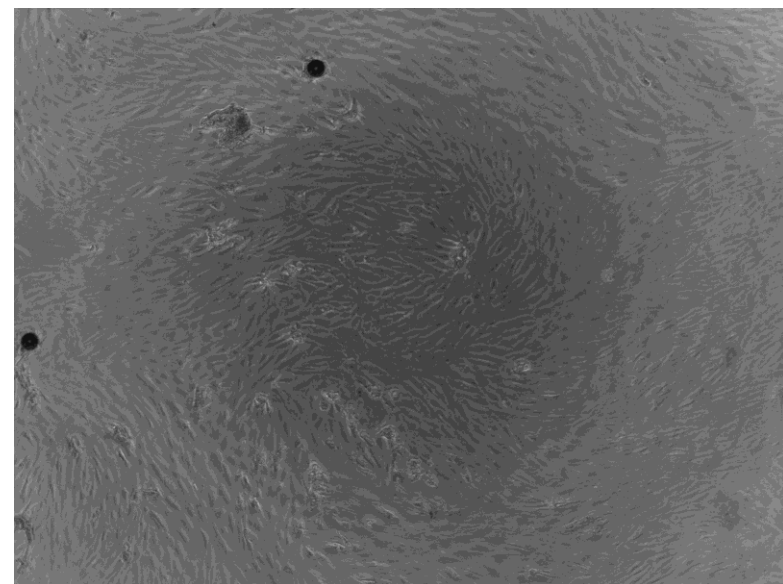
CE
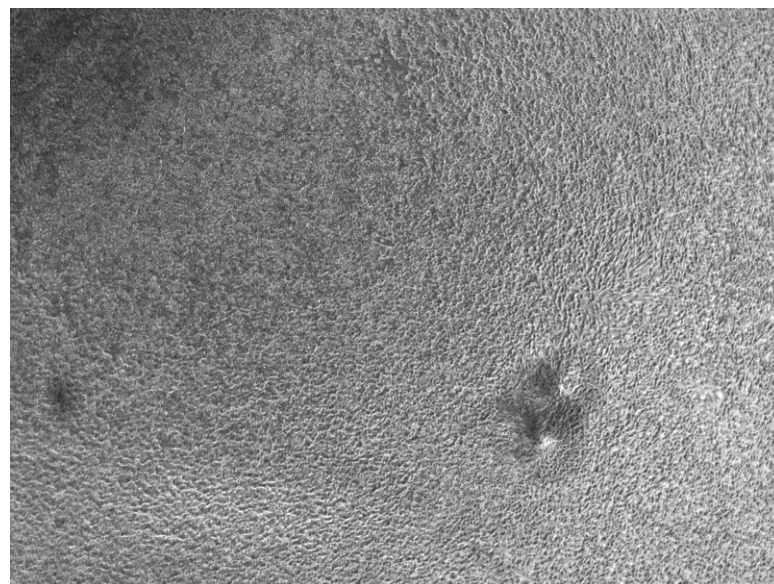
MMG

Immunostaining

Occludin DAPI
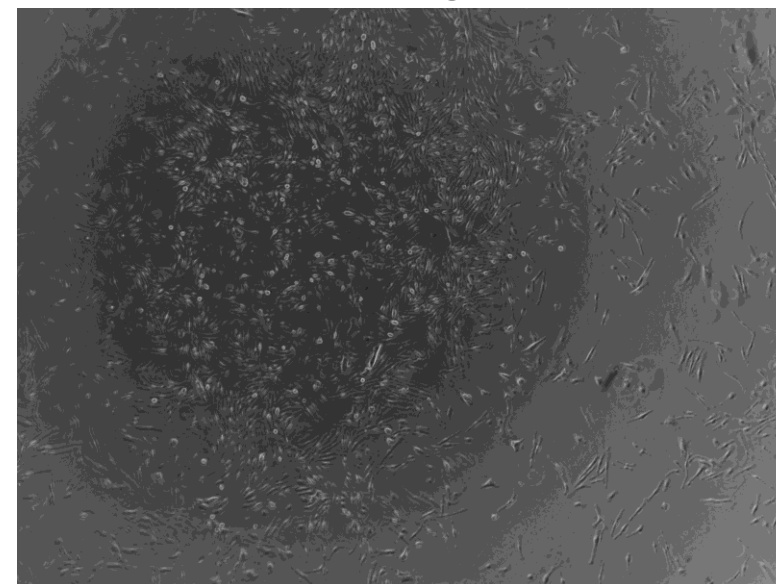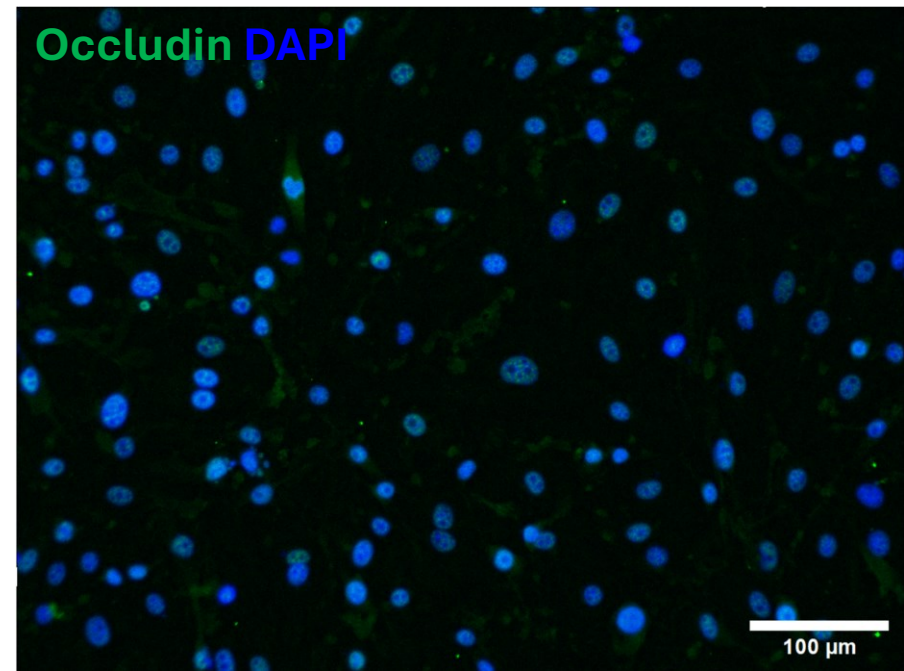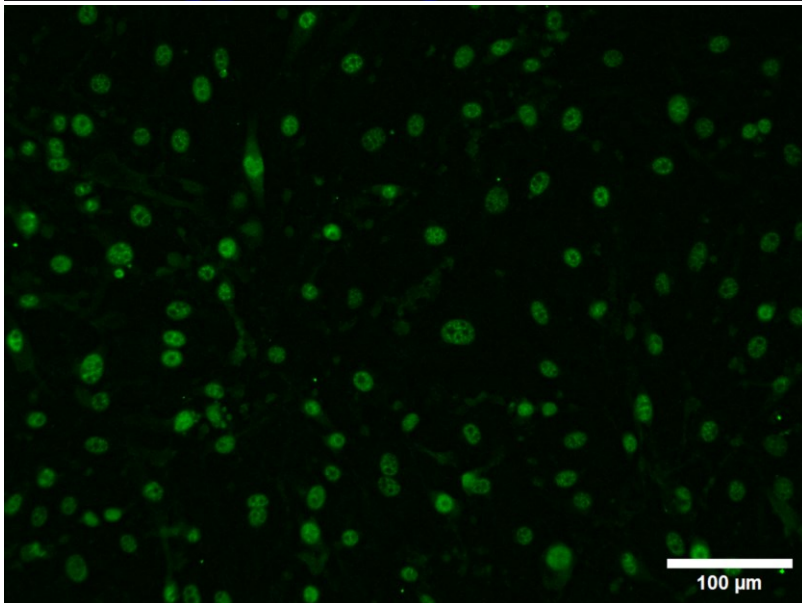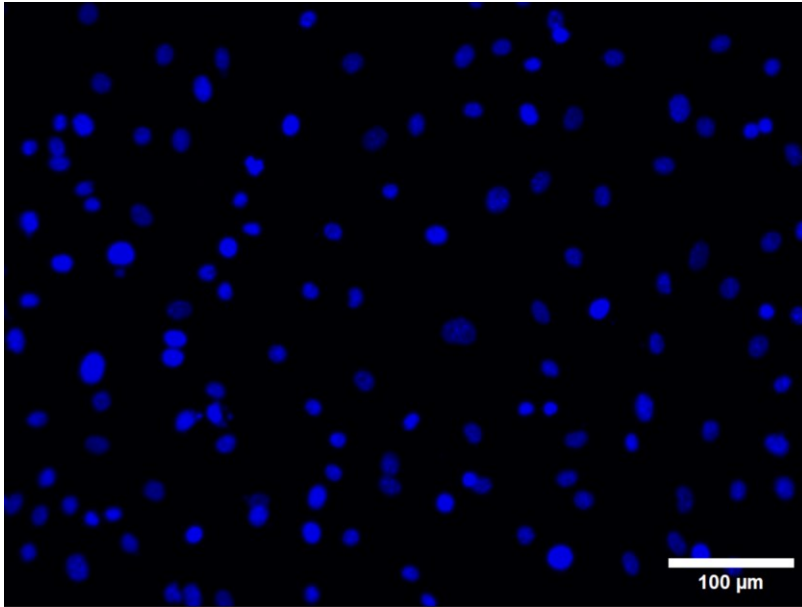
Sample Image:
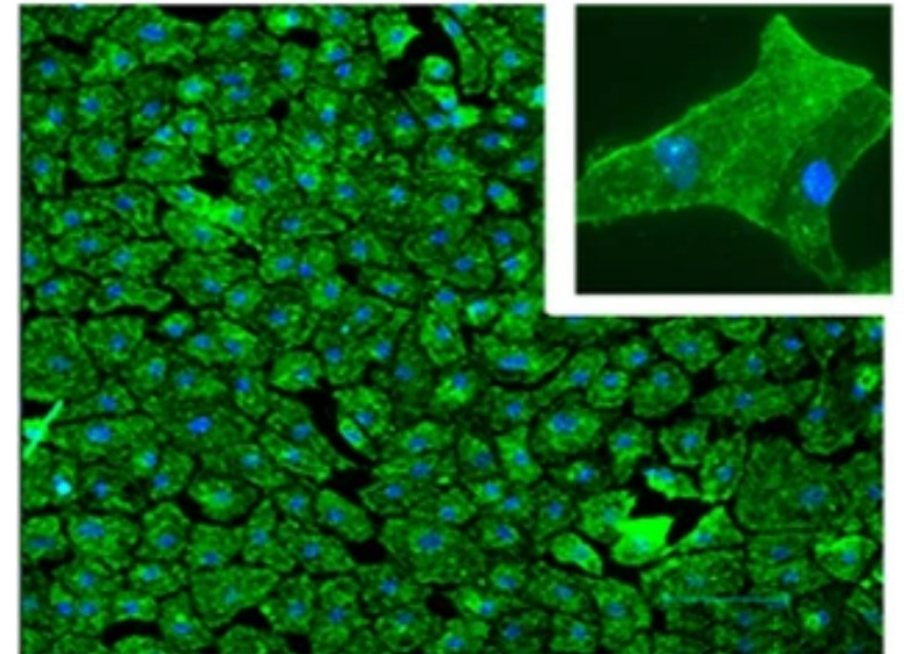
Mohamed et al.

Chemical Exposure

Chemical exposure studies aim to quantitatively determine the best concentration that specified cytokines are causing an increase in cell inflammation using relative signal strength from immunostaining.
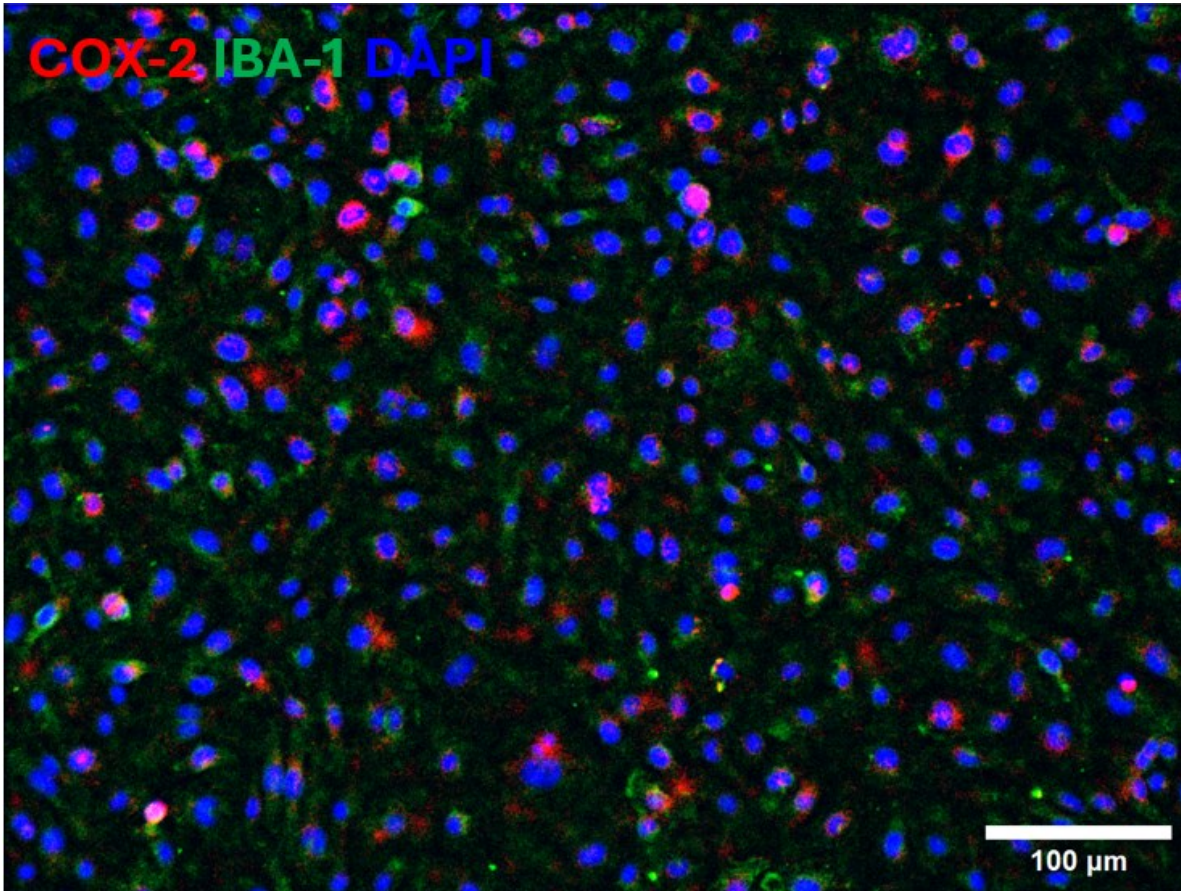
MMG exposed to CCL2 for 24 hours at 100ng/mL
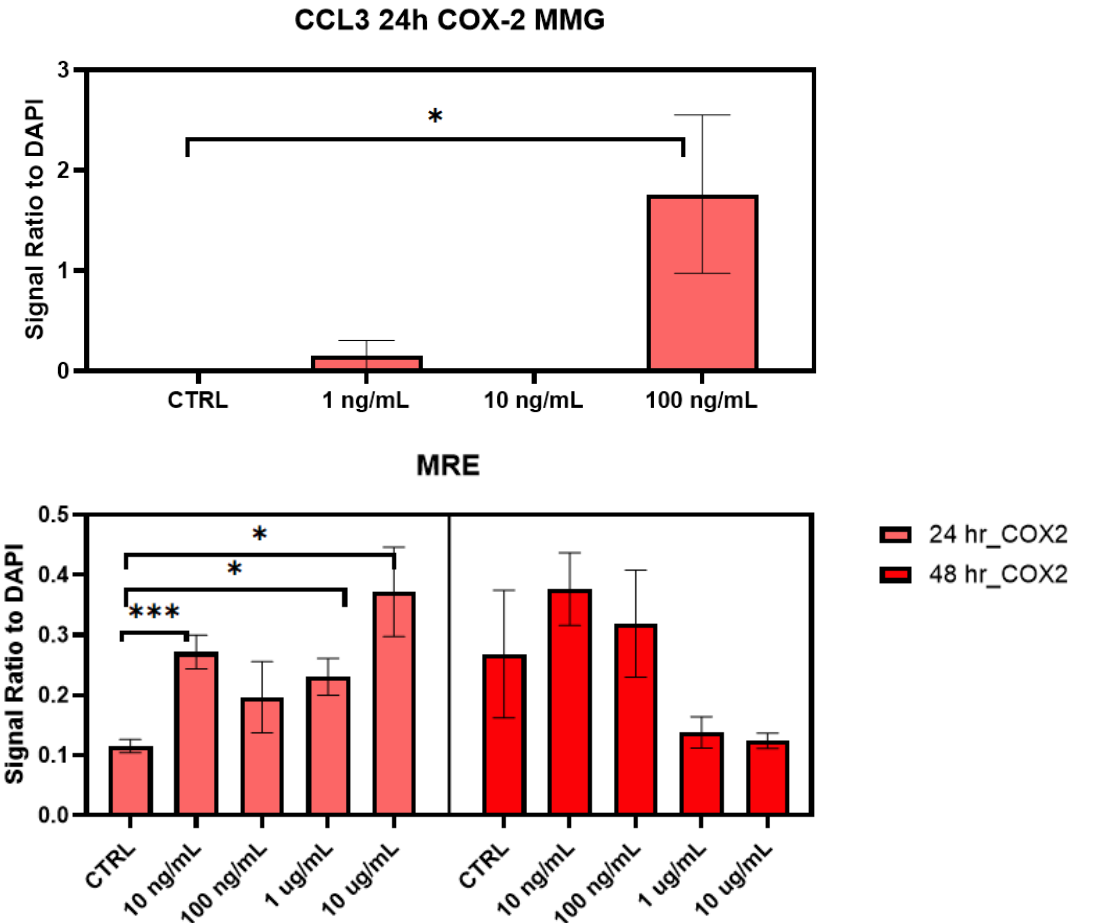
Results of CCL2 Chemical Exposure

Data Analysis

- One of the most important aspects to a lab is ensuring that data is measured and displayed honestly, consistently, and accurately.

2 Point Infiltration Data

How we Count Data

Image of T-cell infiltration at t=24 hours

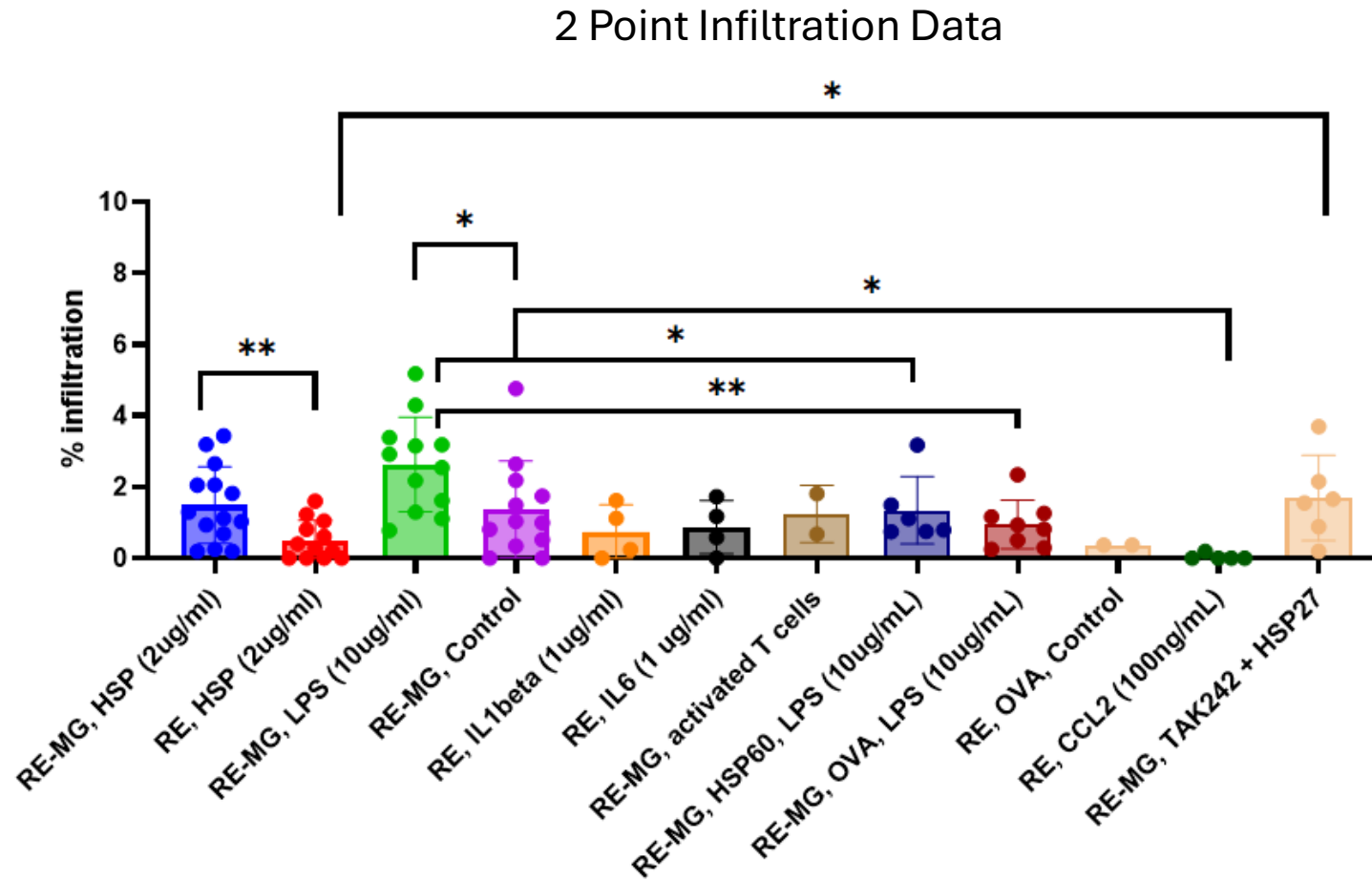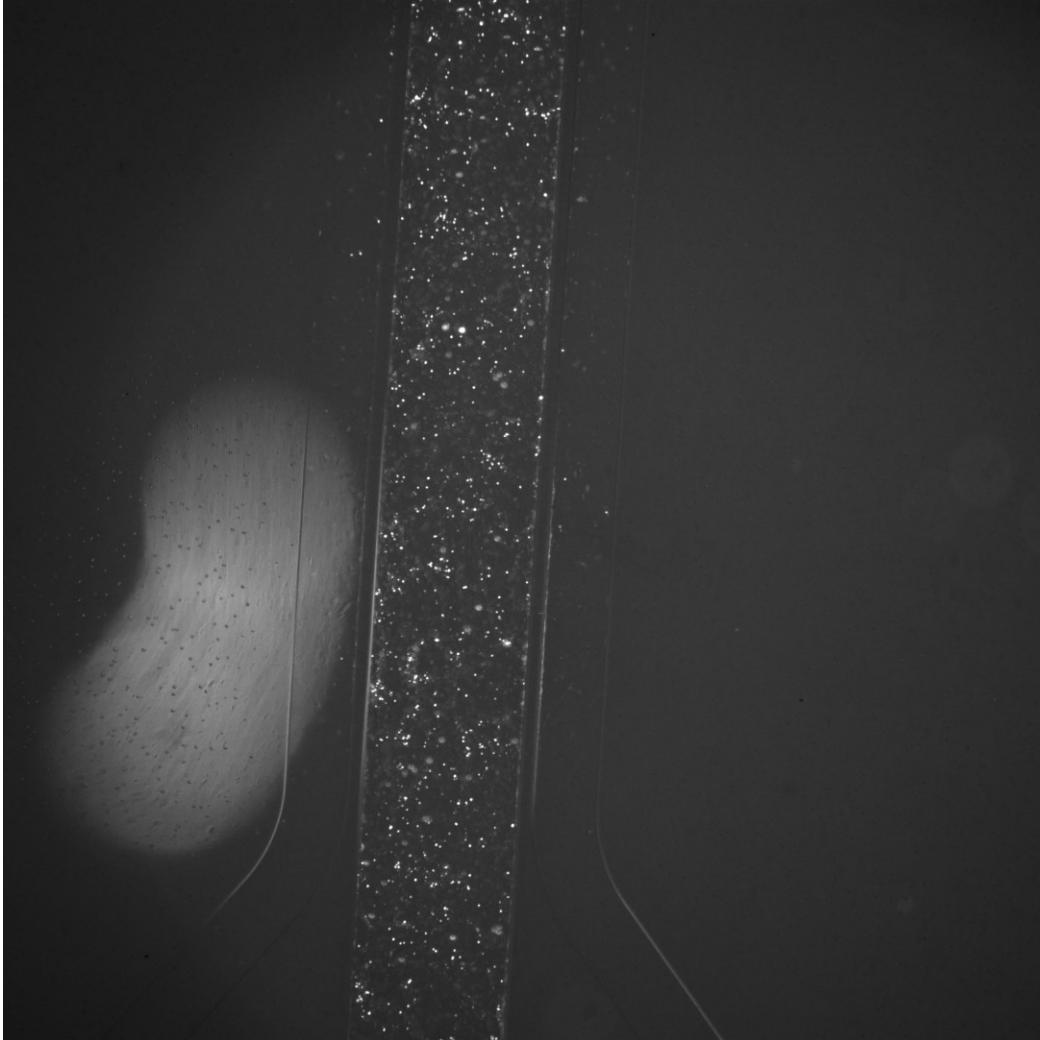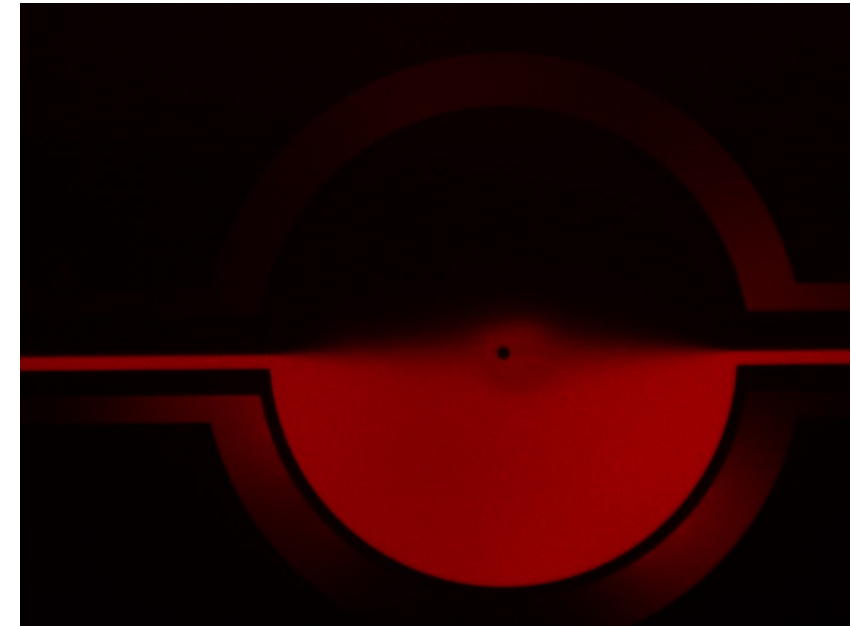| time	n1 top	bottom	middle	n2 top	bottom	middle		total top	bottom	middle
0	3	0	379	0	0	331		3	0	710
1	12	2	394	14	3	312		26	5	706
2	13	2	394	16	3	285		29	5	679
3	17	2	383	15	5	281		32	7	664
4	16	2	388	13	6	281		29	8	669
5	17	2	393	14	6	284		31	8	677
6	15	3	389	14	7	297		29	10	686
7	14	4	385	15	6	304		29	10	689
8	14	4	377	16	6	277		30	10	654
9	16	4	367	14	5	270		30	9	637
10	15	3	371	15	4	272		30	7	643
11	15	3	360	14	5	257		29	8	617
12	16	3	360	14	6	271		30	9	631
13	14	3	355	14	6	281		28	9	636
14	12	3	352	11	5	284		23	8	636
15	13	4	331	10	5	282		23	9	613
16	12	4	331	11	8	287		23	12	618
17	14	5	331	10	7	286		24	12	617
18	11	5	344	10	7	290		21	12	634
19	15	5	336	12	6	308		27	11	644
20	16	5	339	12	8	306		28	13	645
21	16	5	336	11	8	299		27	13	635
22	16	4	334	11	9	294		27	13	628
23	16	4	352	9	8	290		25	12	642
24	15	5	328	9	9	291		24	14	619
Average			360.36			288.8	324.58			649.16
Percentage	4.62136	1.54045		2.77281	2.77281			3.69709	2.15663	

Chip 51 T-cell infiltration data

Co-flow

The goal is to be able to seed multiple cell types in the same channel using different inlets.

These images are from dye only:

The inner BRB
- Müller cell
- Microglia
- Neuron
- Pericyte
- Endothelial cell
- Basement membrane

The outer BRB
- Photoreceptors
- Tight junctions
- Retinal pigment epithelial cell
- Bruch's Membrane
- Choroid
- Sclera

http://dx.doi.org/10.1097/CM9.0000000000001015
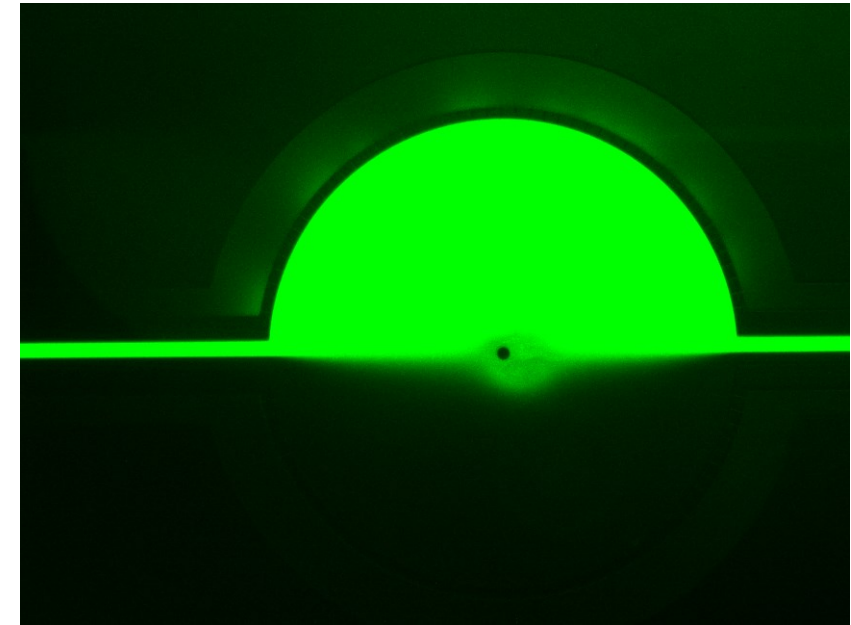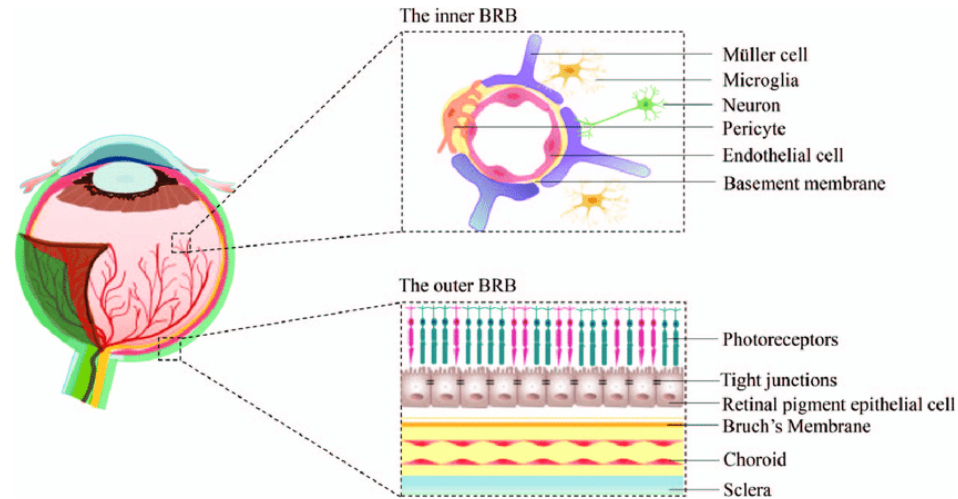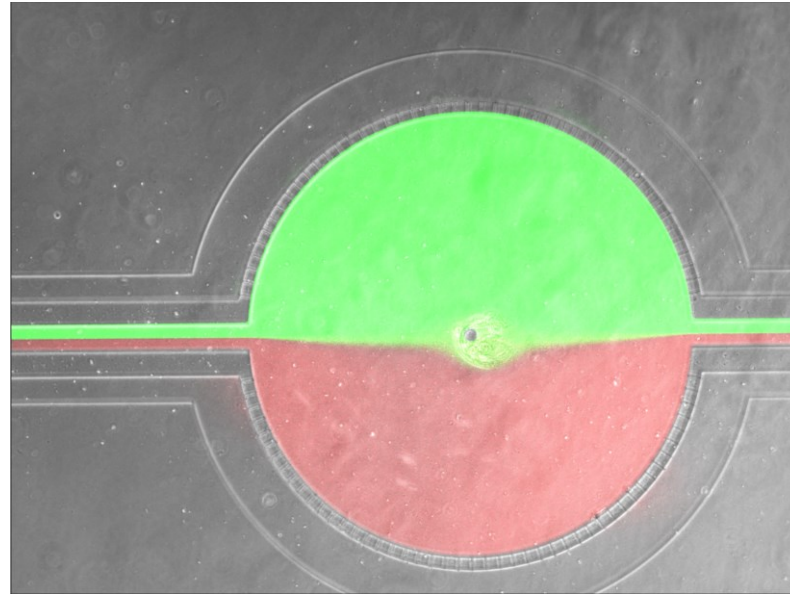
Chip Cleaning

One of the biggest issues we ran into was properly cleaning all cells, debris, and Matrigel out of chips. I created a 1:1 (v/v) solution of Trypsin and EDTA solution that removes everything after incubation overnight.
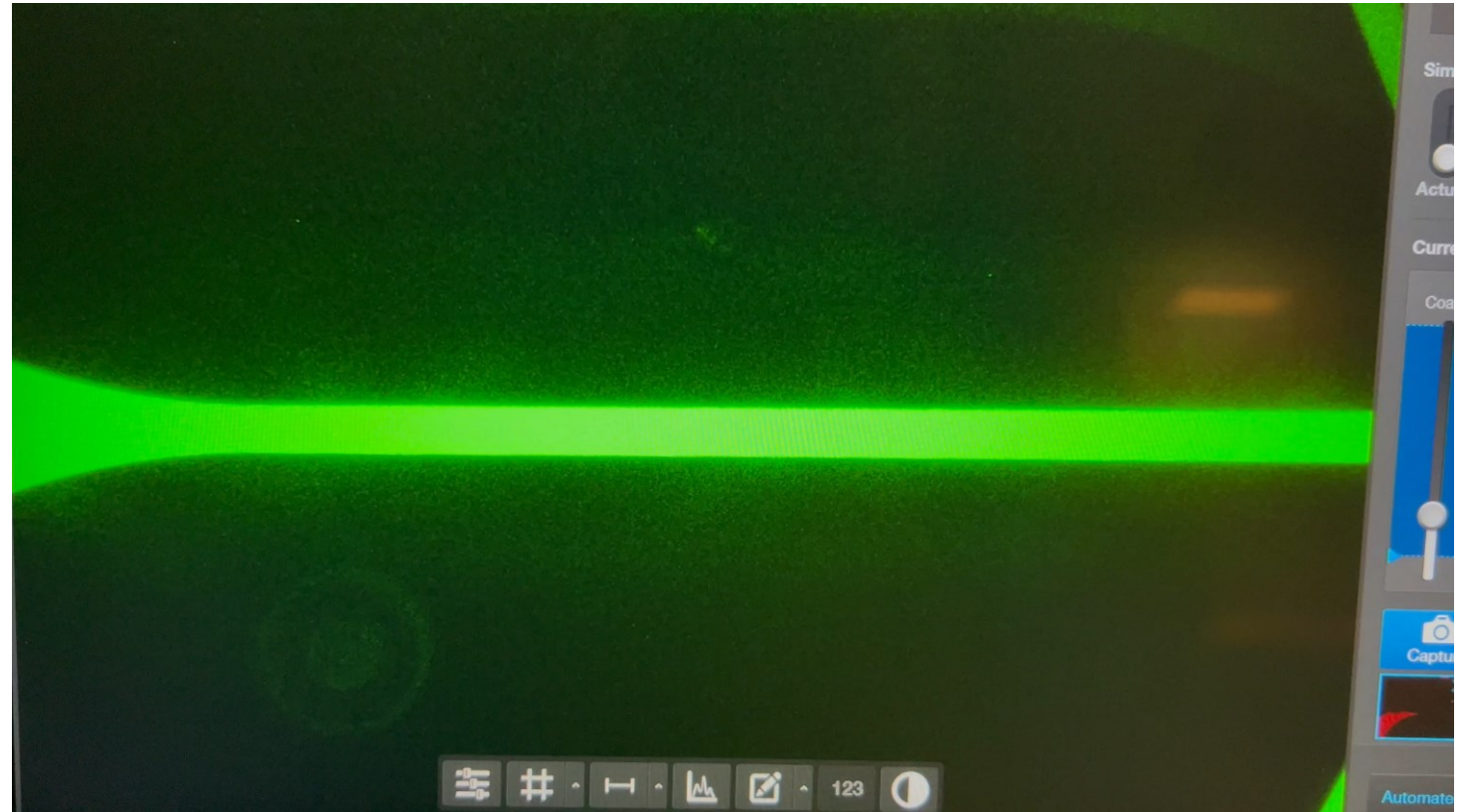
Agriculture Application

- As greenhouse gases and the demand for meats increases, alternatives must be found

- One of the setbacks to biofabricated meats is replicating the taste and texture of traditionally slaughtered meats [1]

- The co-flow project on a large scale could be used to increase the quality of biofabricated meats by increasing variety of cells
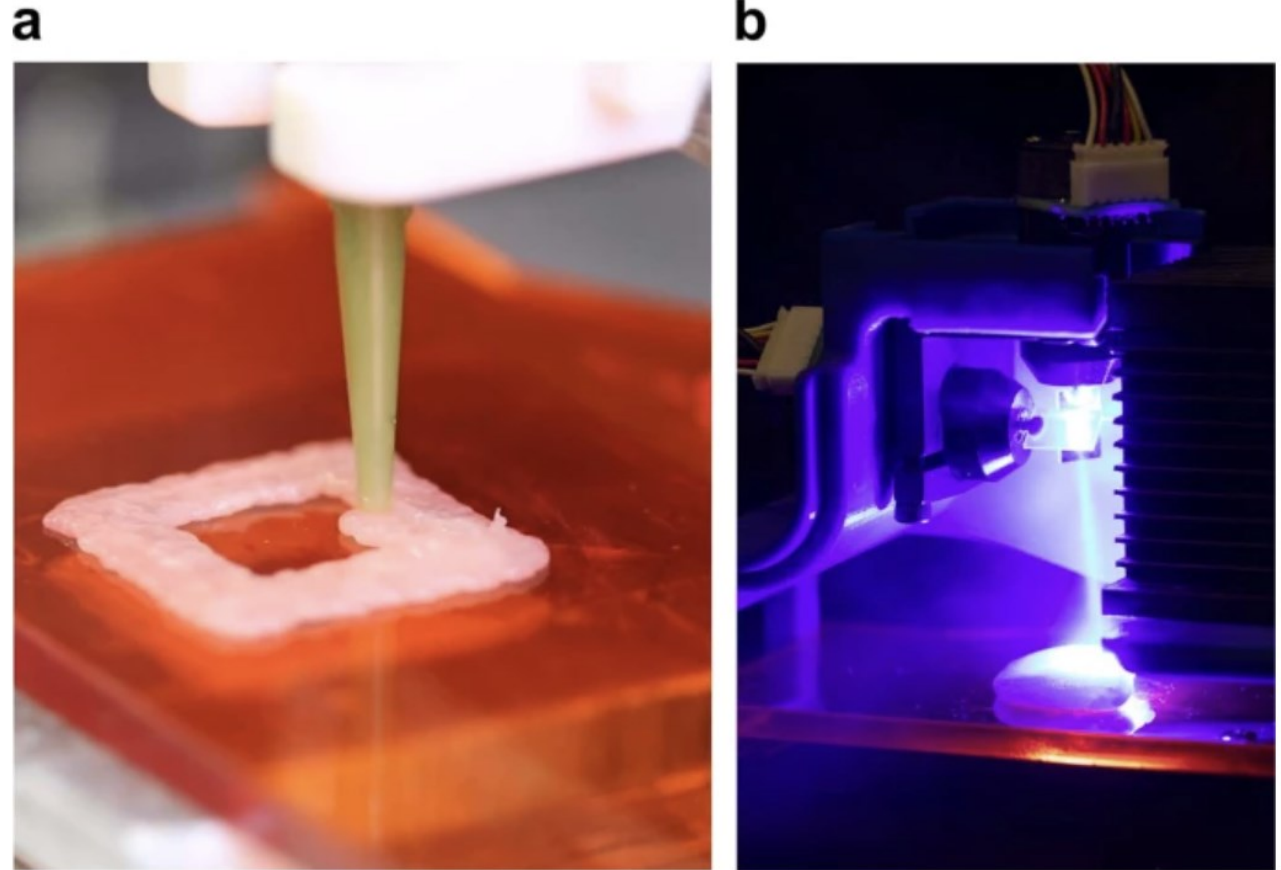

Image of 3D printed chicken and simultaneous chicken cooking via laser. Dong et al.

[1] - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4827462/

Outlook

- I got a great preview of a ton of different routes I can take in college.

- I learned how to become a collaborative researcher and how a real laboratory works.

- Co-flow could implement a gelatin-collagen solution instead of Matrigel.

- Implementing more cell types into microfluidics chips is the next step.

- I work in a blood vessel centered lab and will be able to apply my knowledge if I return.

Final Notes

- My biggest takeaway from MIT is how collaborative and supportive the culture is.

- Everyone in the lab group was a great mentor to me in some way.

- Thank you to the Science Influencers grant for funding me and the Qi lab for hosting me.