In vitro assessment of cell-based drug delivery systems

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Moffitt Cancer Center

July 17th, 2025

Issues in Nanomedicine Cancer Drug Development

Insights

Nanotechnology: Is the Magic Bullet Becoming Reality?

By Richard A. Stein - January 21, 2014

GEN Genetic Engineering & Biotechnology News

BIND THERAPEUTICS

A new way of targeting disease

ACS NANO

What Went Wrong with Anticancer Nanomedicine Design and How to Make It Right

Duxin Sun,* Simon Zhou, and Wei Gao

ACS Nano 2020, 14, 12281−12290

Drug Delivery: Too Much Complexity, Not Enough Reproducibility?

*Jean-Christophe Leroux**

Angewandte Chemie International Edition

Published: 26 April 2016

Analysis of nanoparticle delivery to tumours

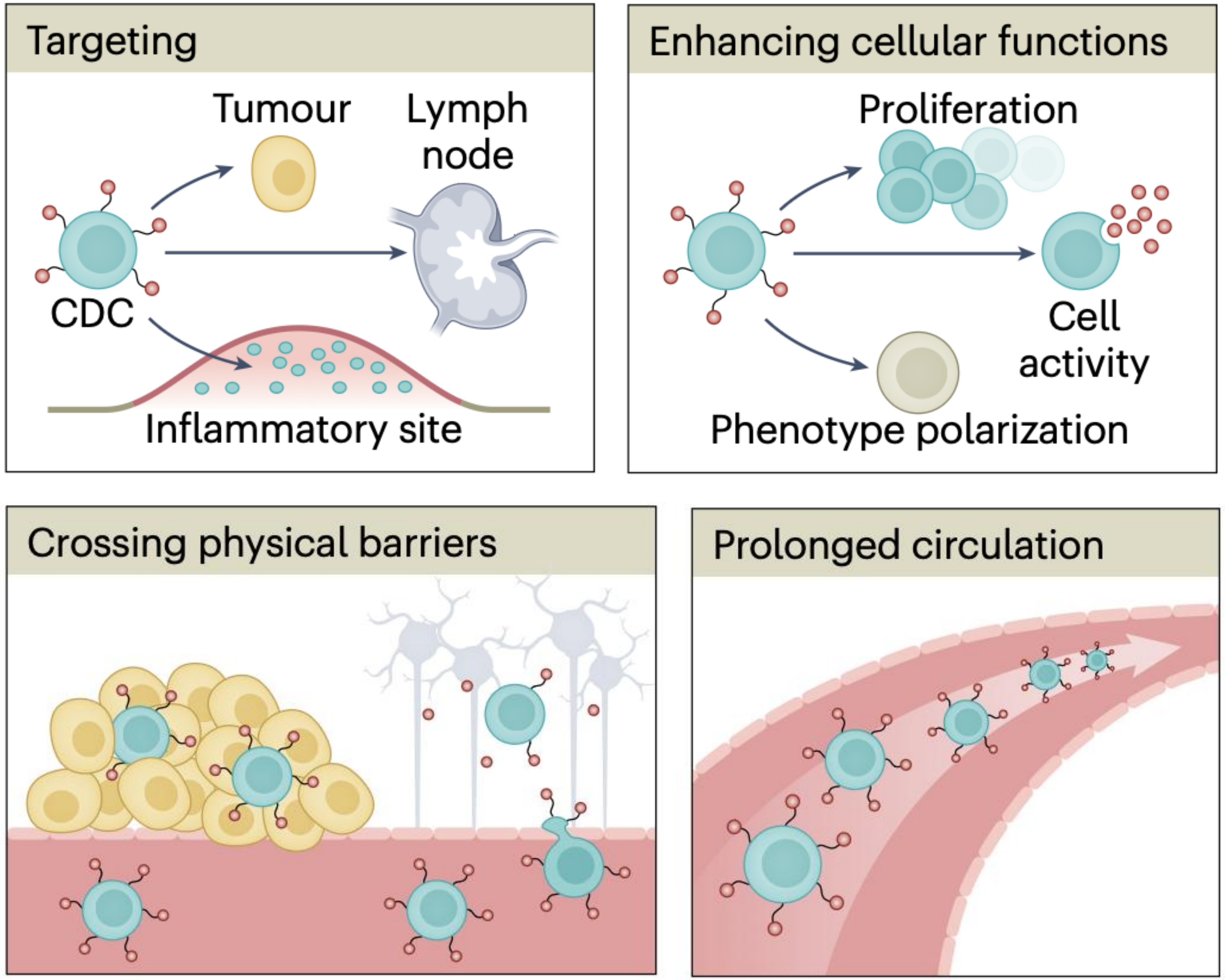
Stefan Wilhelm, Anthony J. Tavares, Qin Dai, Seiichi Ohta, Julie Audet, Harold F. Dvorak & Warren C. W. Chan

Nature Reviews Materials **1**, Article number: 16014 (2016) | Cite this article

CERULEAN Pharma Inc.

Pioneering the Field of Nanobiology

Cell-based drug delivery



Nat Biomed Eng 8(11):1347-1365 (2024)

Desire to reduce animal use in scientific research

Science

FDA no longer needs to require animal tests before human drug trials

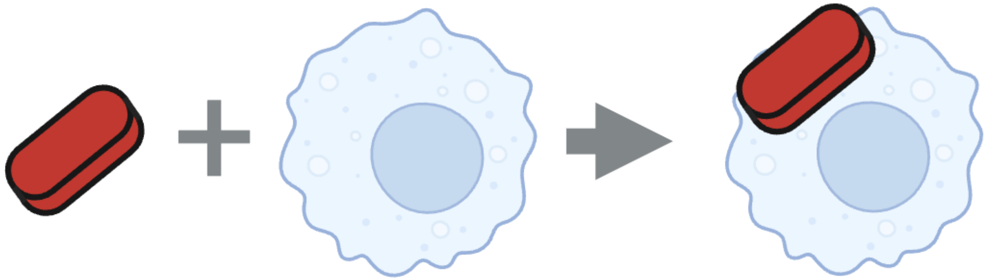
10 JAN 2023 · 5:30 PM ET · BY MEREDITH WADMAN

NEWS RELEASE | Jul 8, 2025

In Landmark Shift, NIH Announces No More Exclusive Funding for Animal Experiments

Cell-based drug delivery

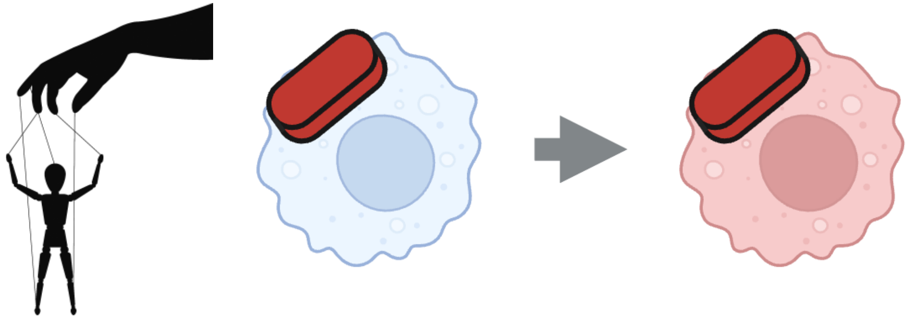
Cellular Backpacks



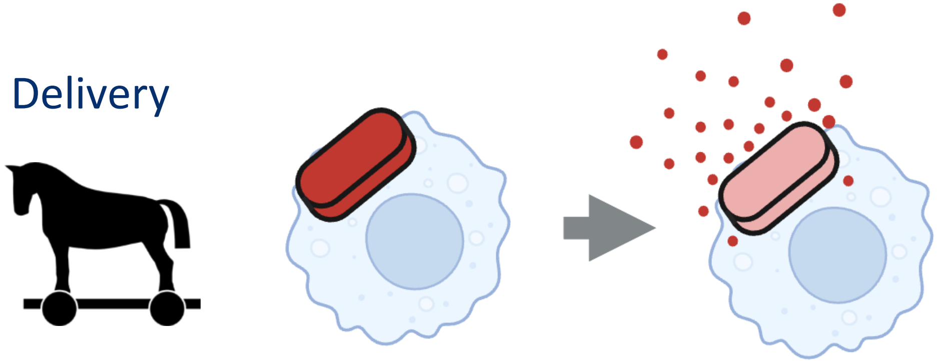
Geometry Prevents Phagocytosis

Methods of Employing Backpacks

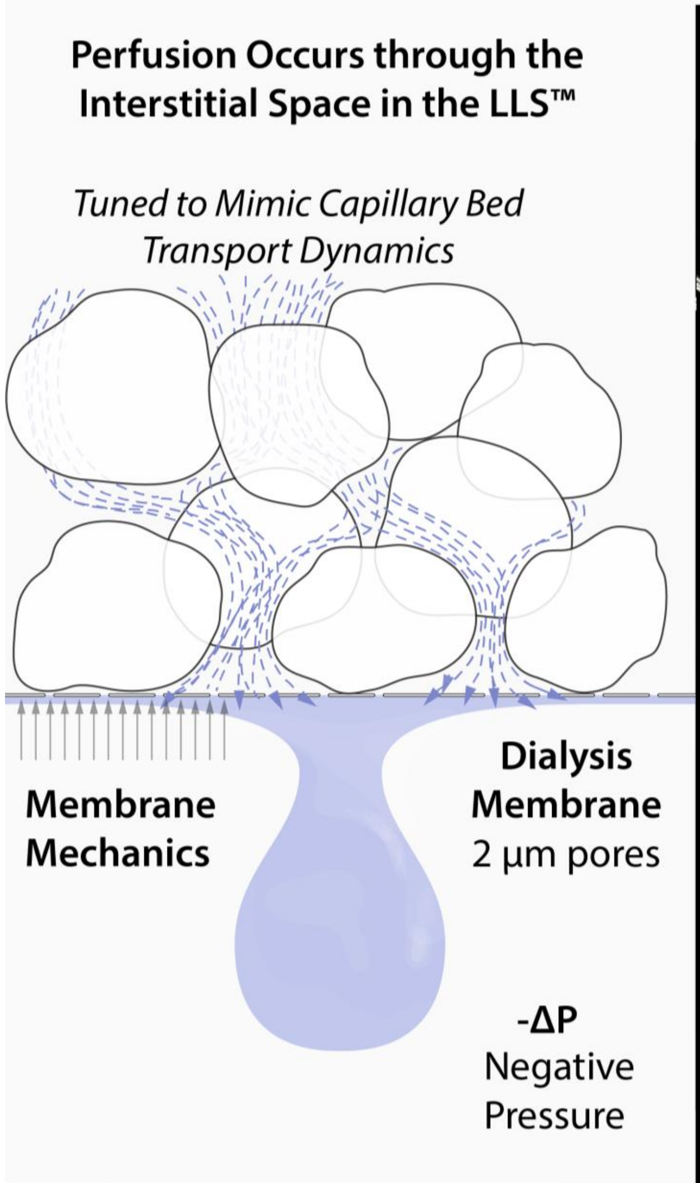
Control

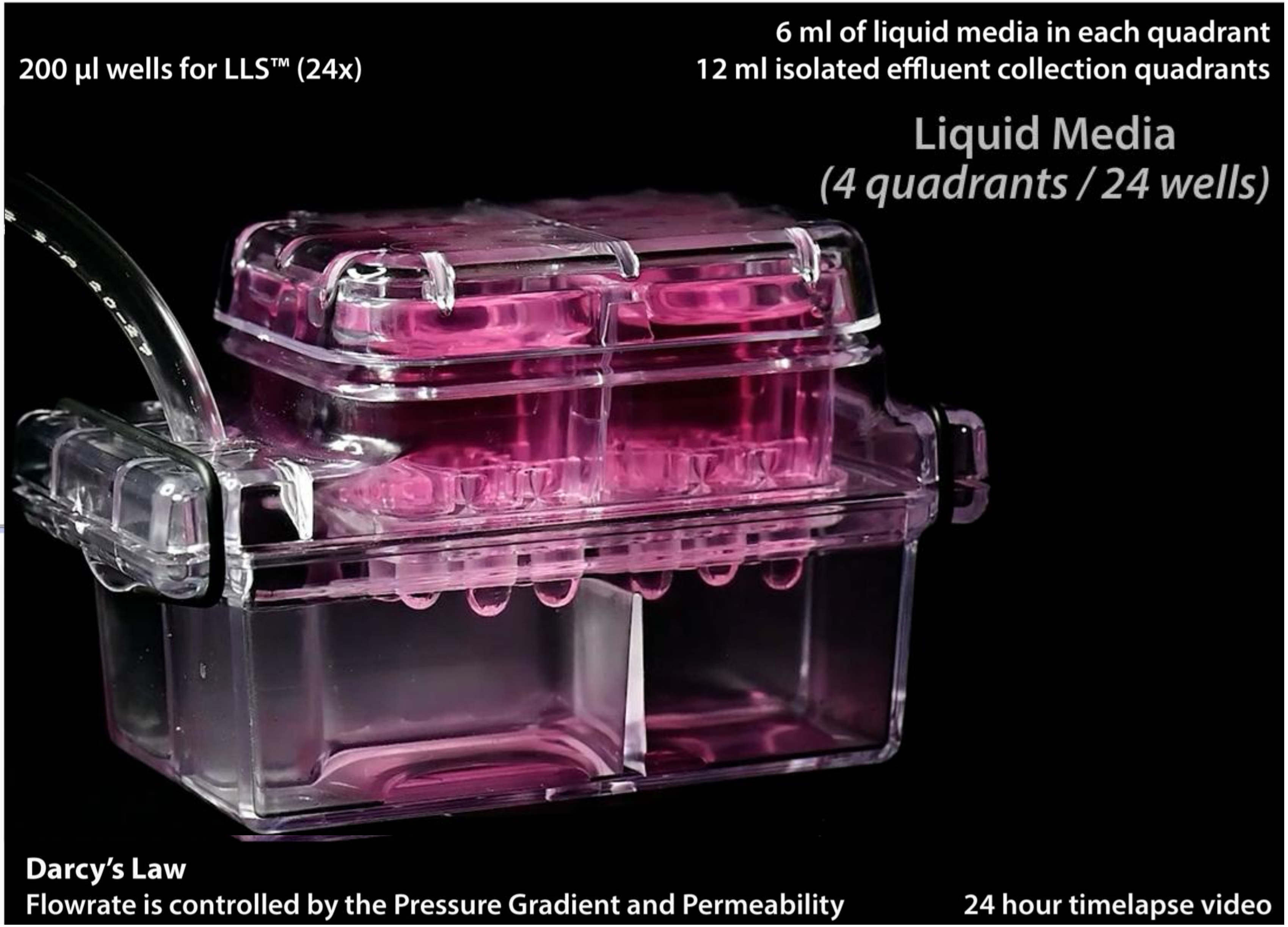


Delivery

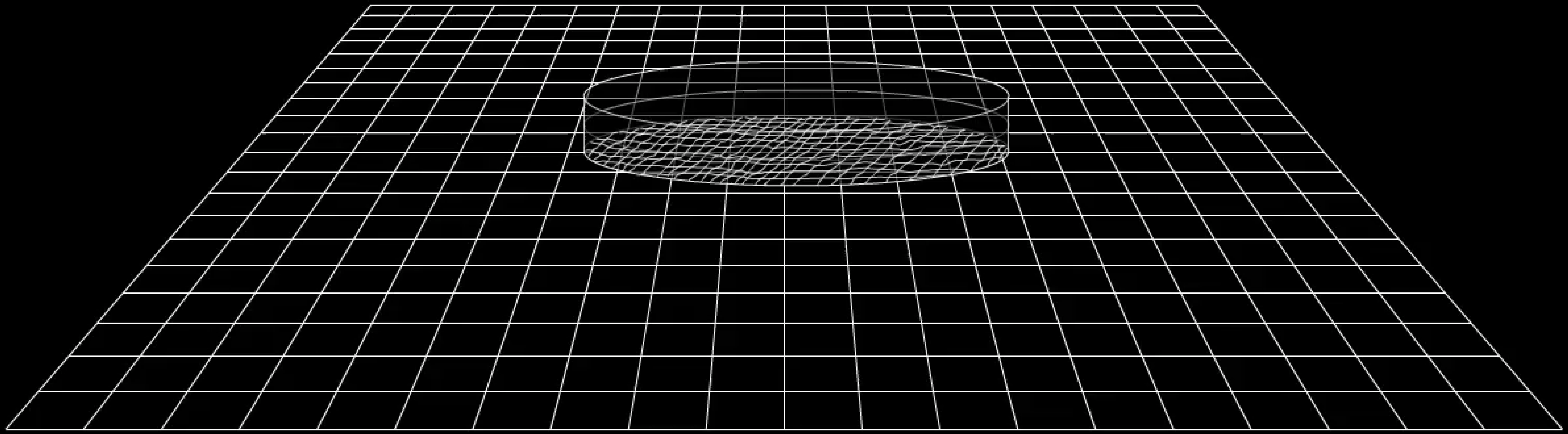


In vitro experimental setup

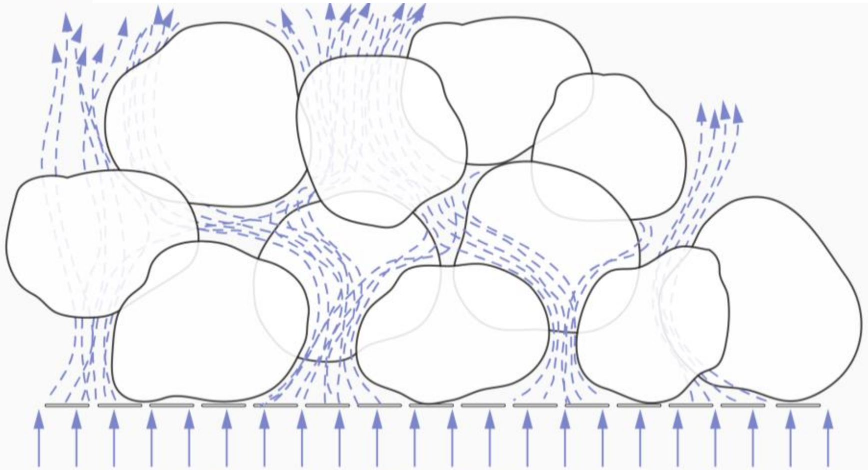


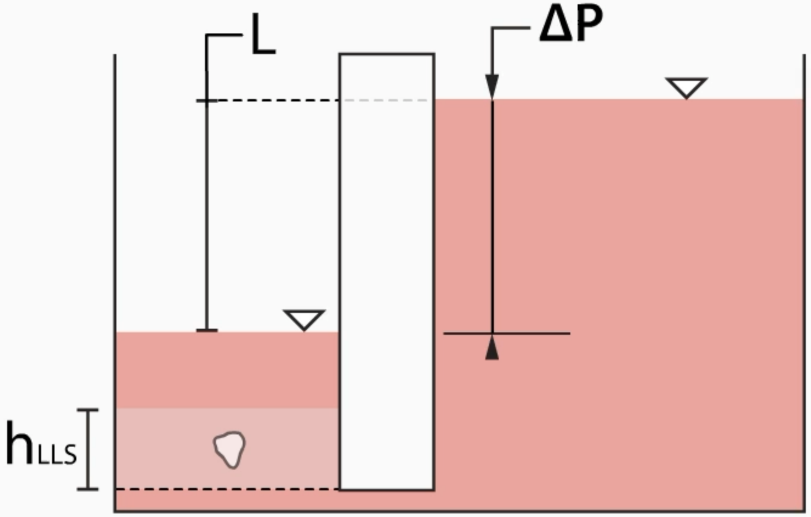


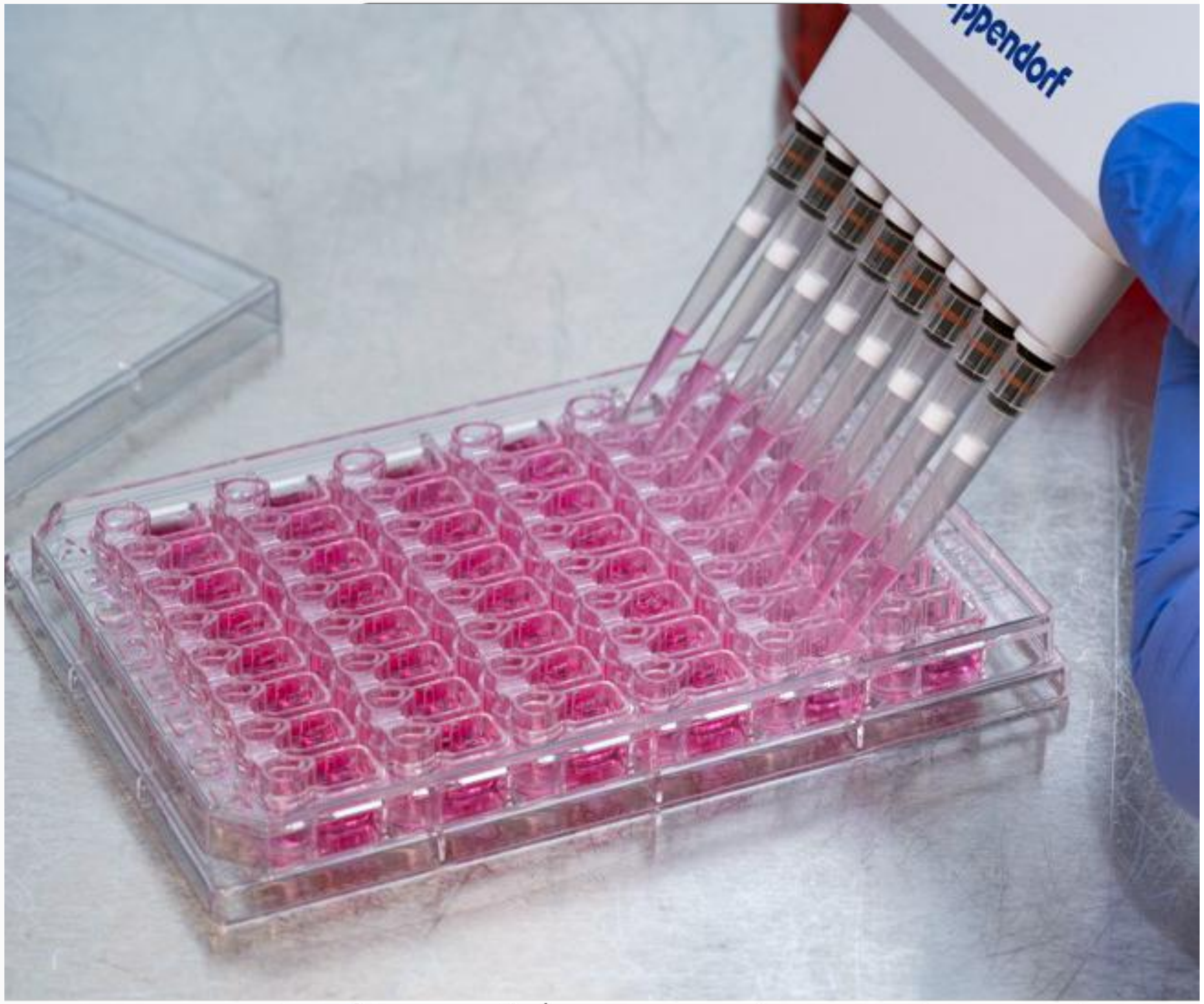
Biology Research in Two Dimensions



Perfusion plates

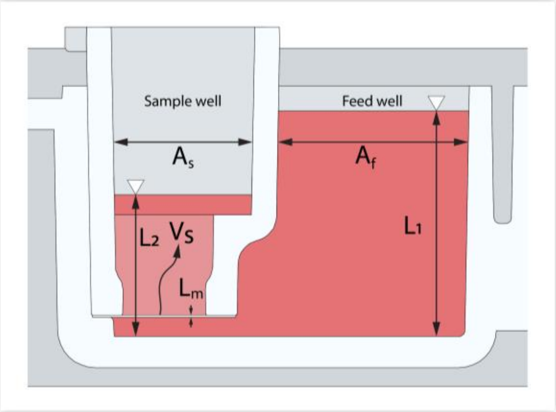


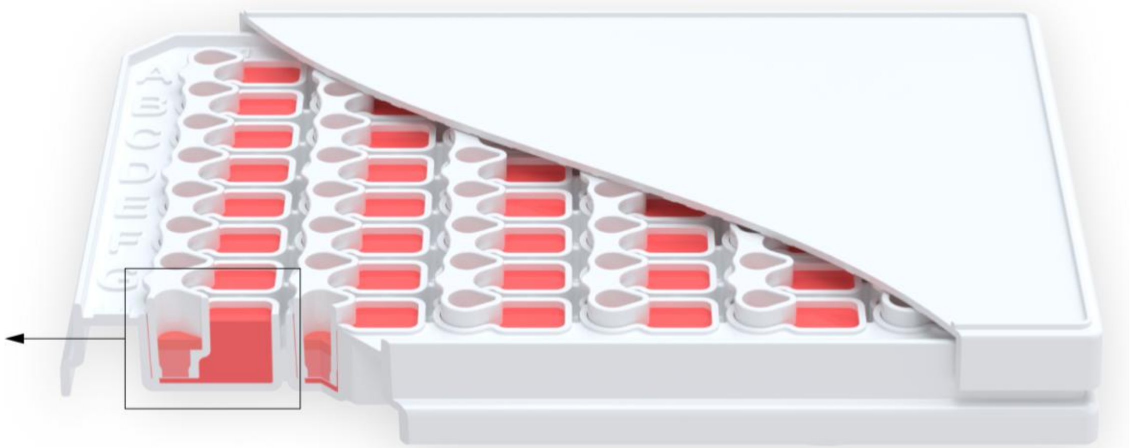


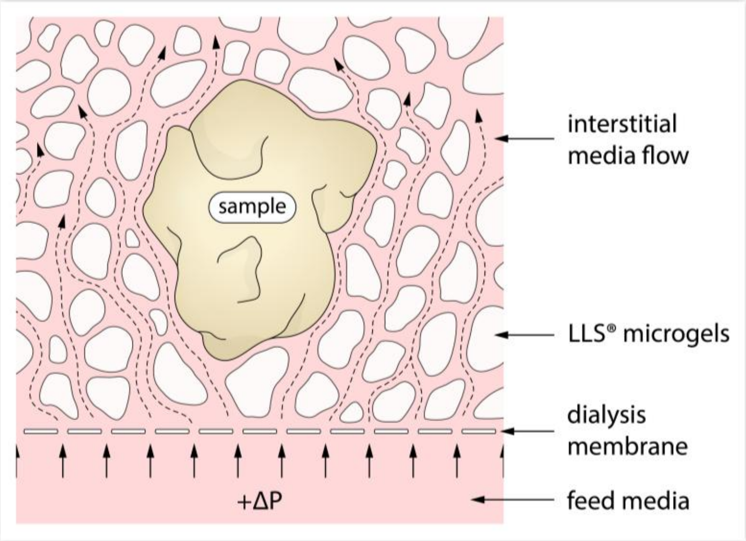


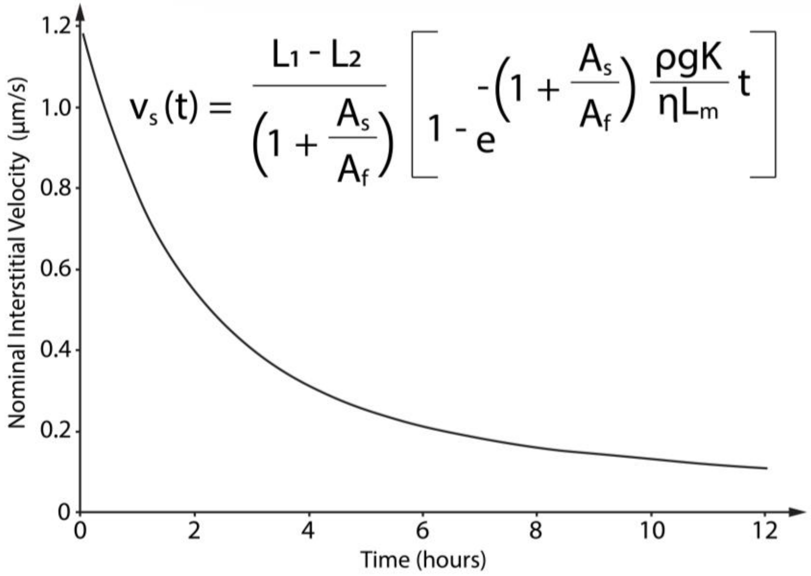
48 paired perfusion wells | *asymptotically approach static culture*

Perfusion plates



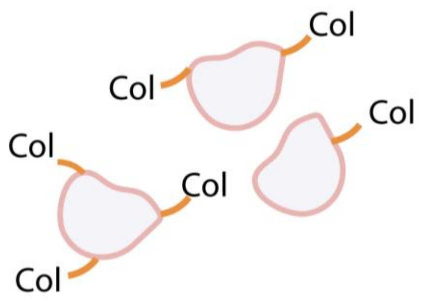


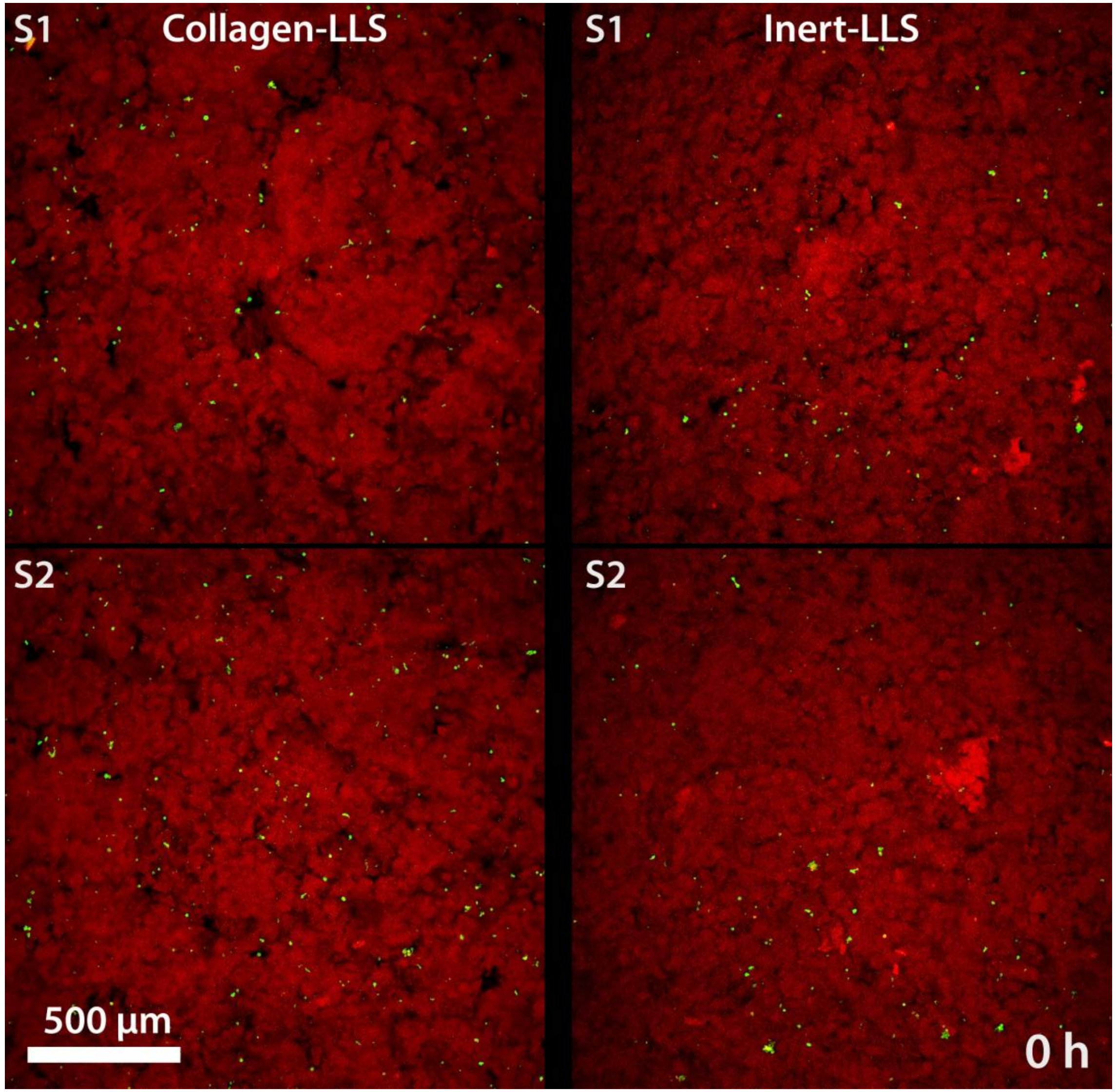


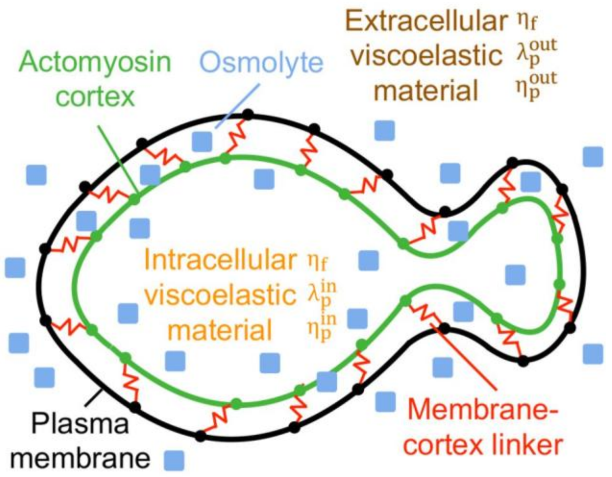


Keeps tissue explants viable for > 2 months

T cell migration in liquid-like solid



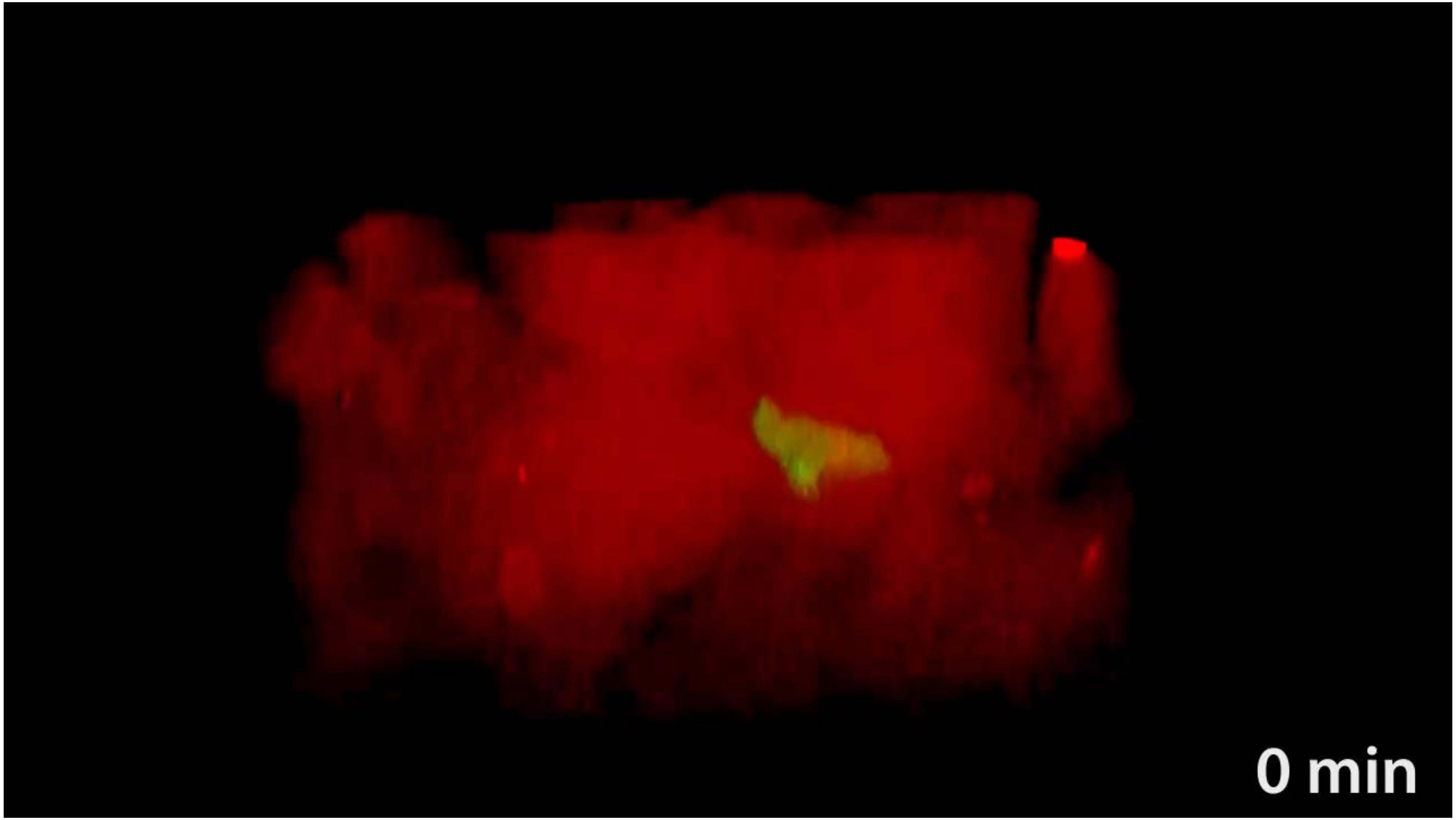




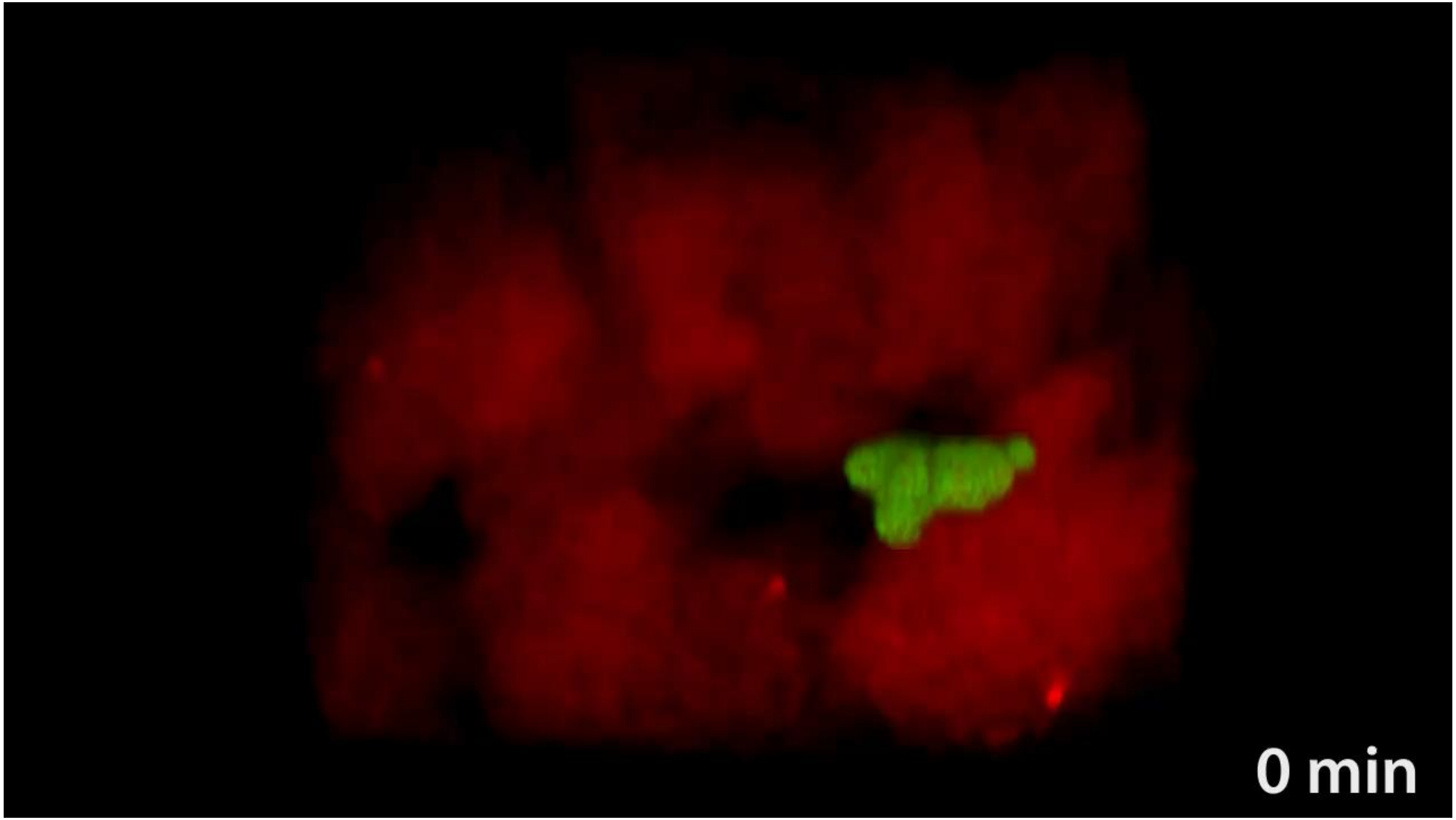
Human CD8+ T cells
CD3 + CD28 activation

Alonso-Matilla et al. Submitted.

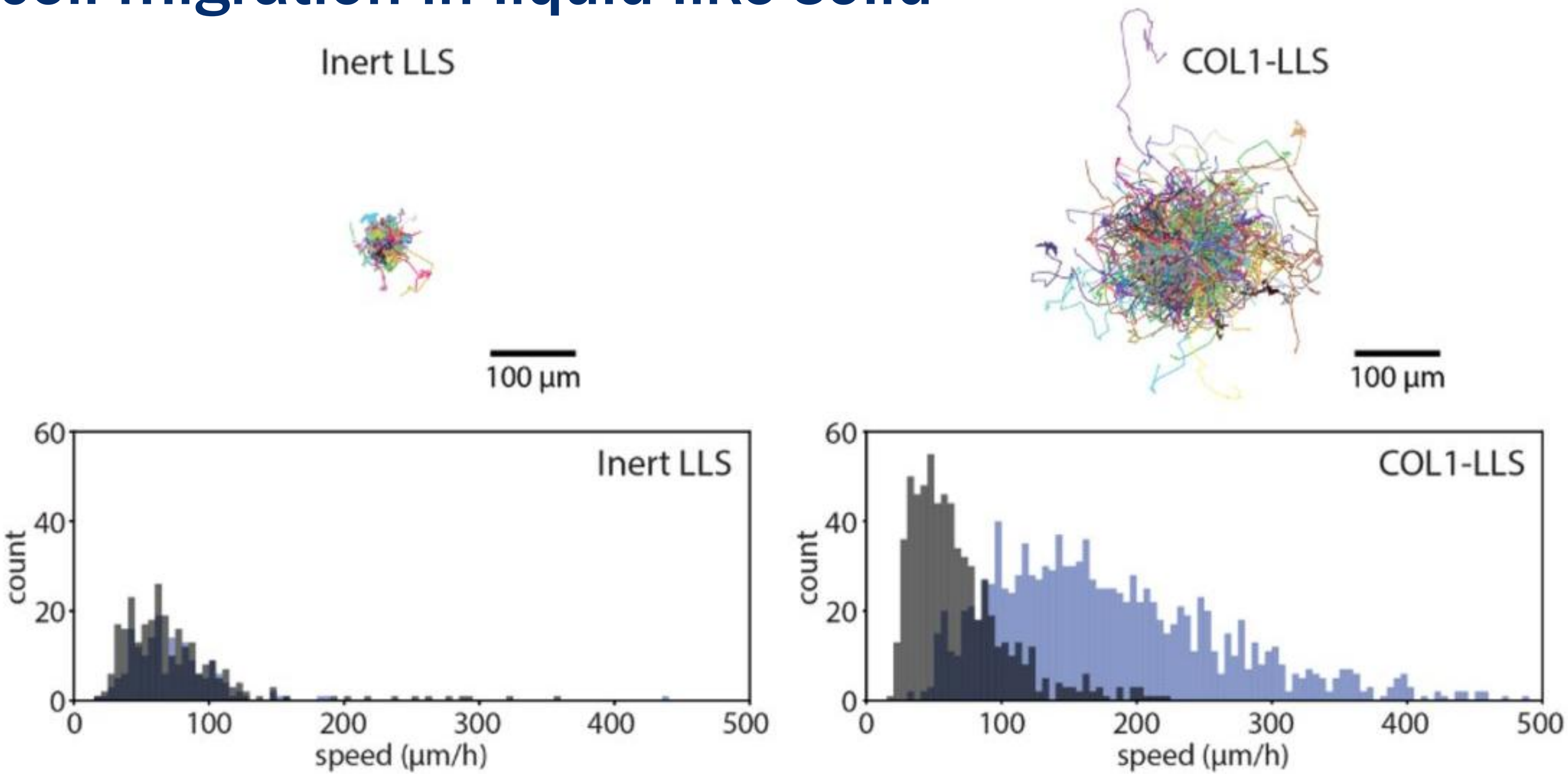
T cell migration in liquid-like solid



T cell migration in liquid-like solid



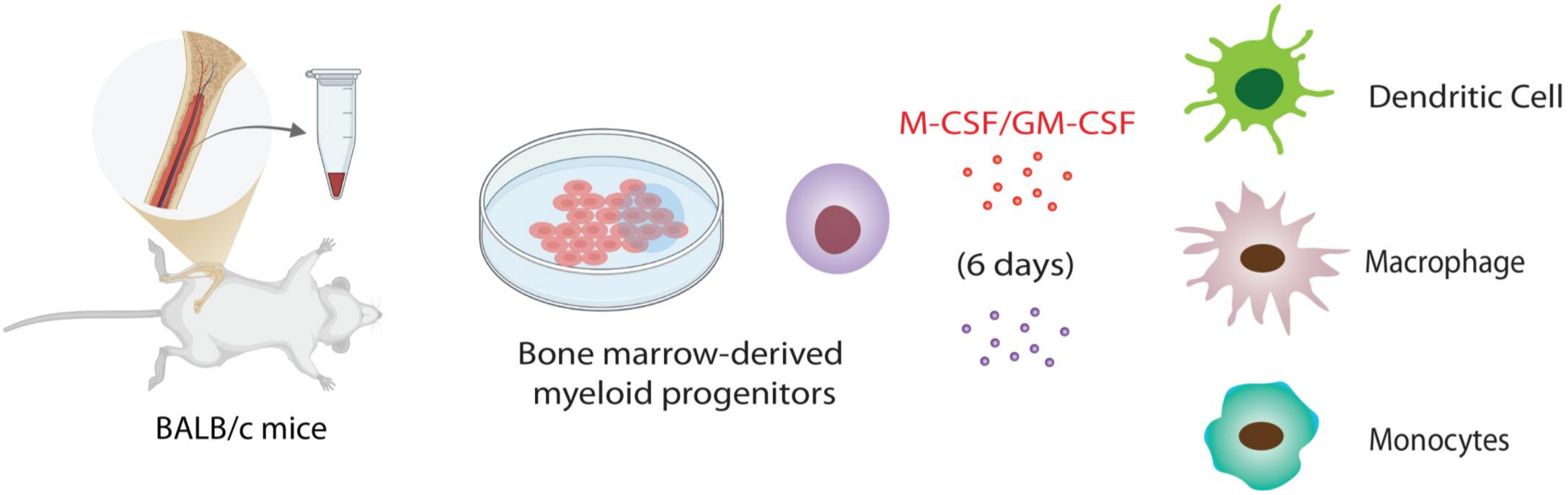
T cell migration in liquid-like solid



T cells migrate faster and farther in collagen coated LLS

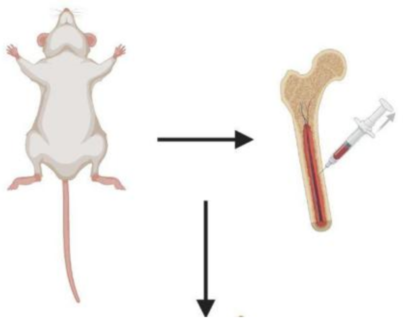
Alonso-Matilla et al. Submitted.

Myeloid Cell Differentiation



Myeloid cell characterization

Bone marrow extraction

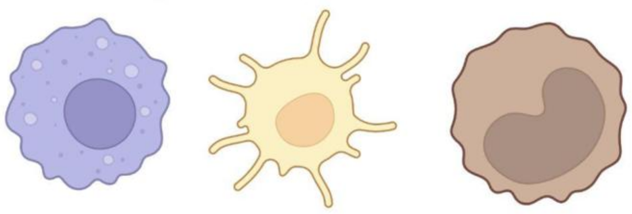


Cell differentiation

Dendritic Cells

Macrophages

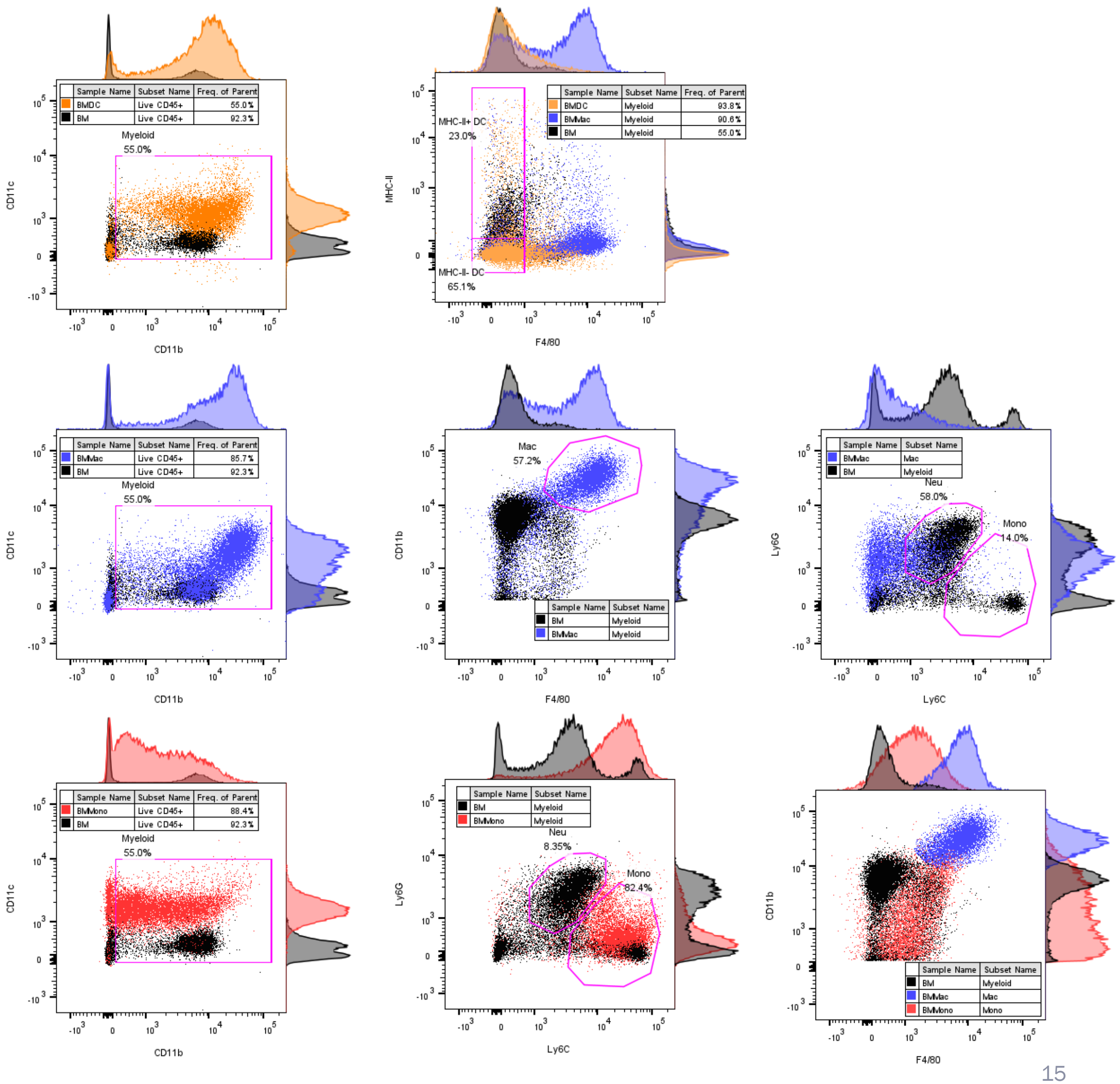
Monocytes



Dendritic Cells

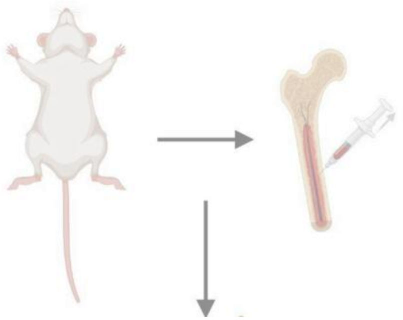
Macrophages

Monocytes



In vitro myeloid cell migration

Bone marrow extraction

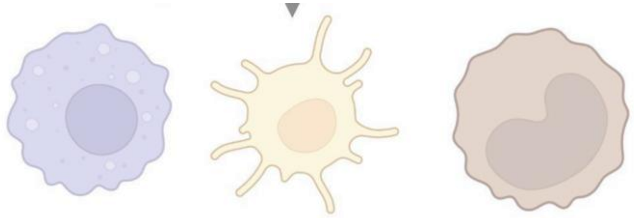


Cell differentiation

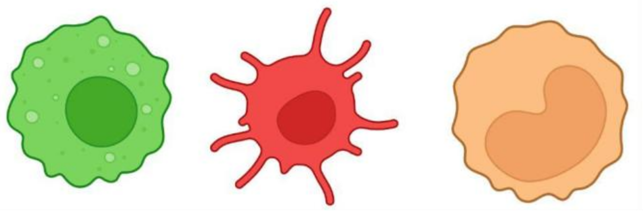
Dendritic Cells

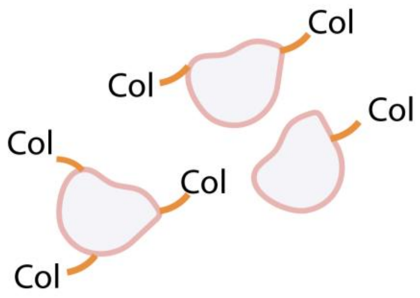
Macrophages

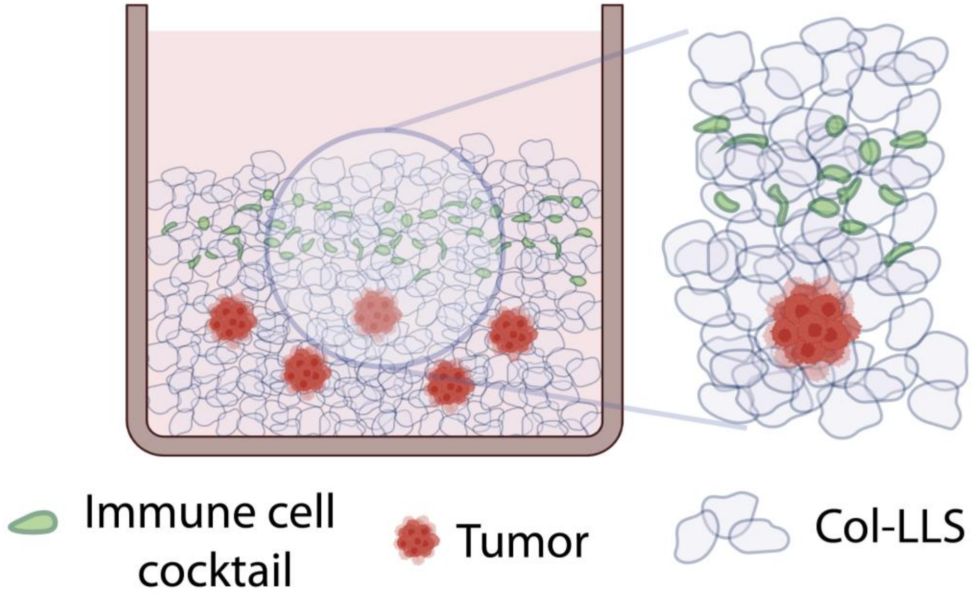
Monocytes



Cell labelling (fluorescent dye)



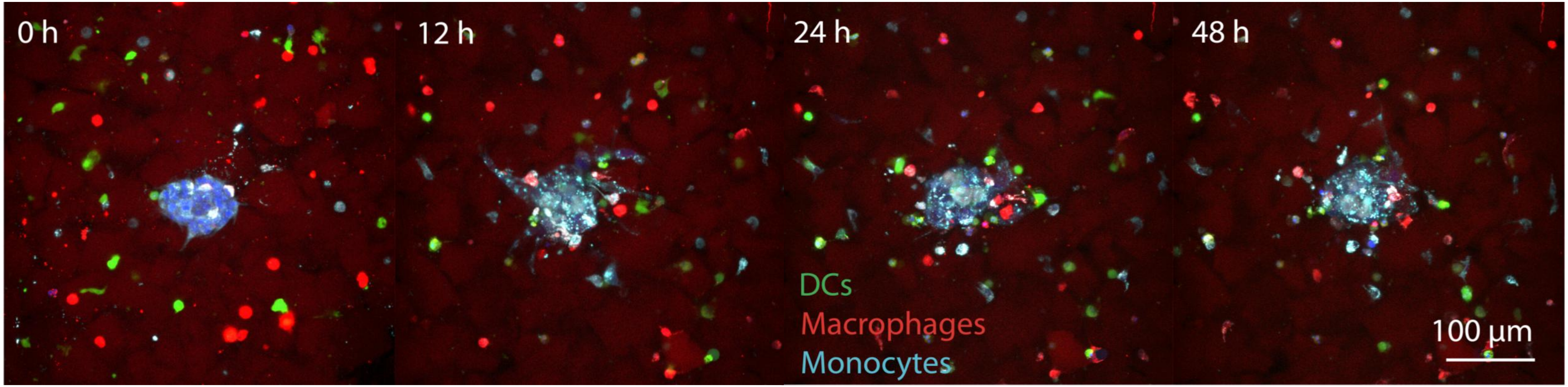




Tumor adhesion on Collagen-LLS

4T1 mammary carcinoma explants

In vitro myeloid cell migration

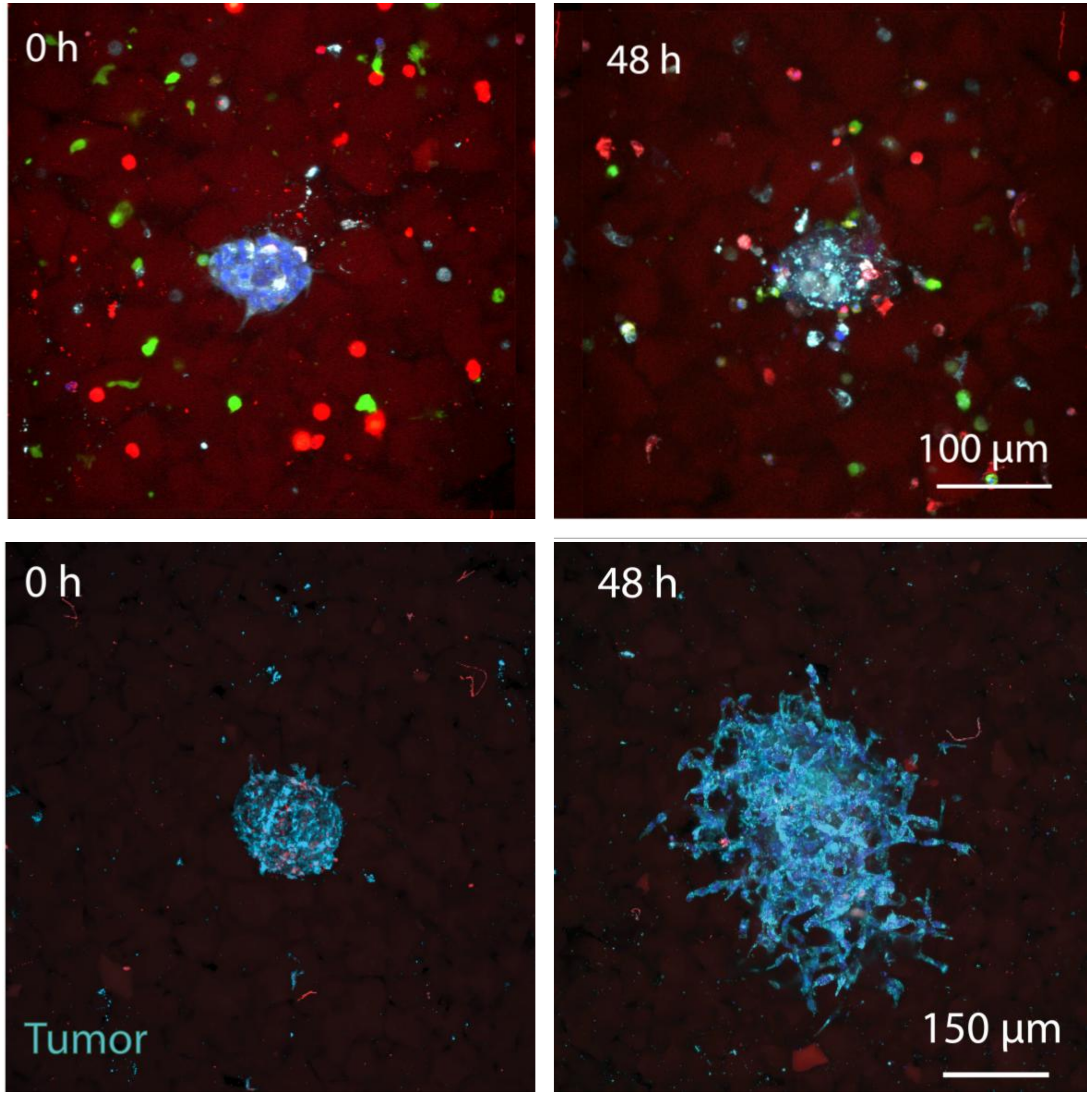


4T1 mammary carcinoma explants

In vitro myeloid cell migration

Immune cells

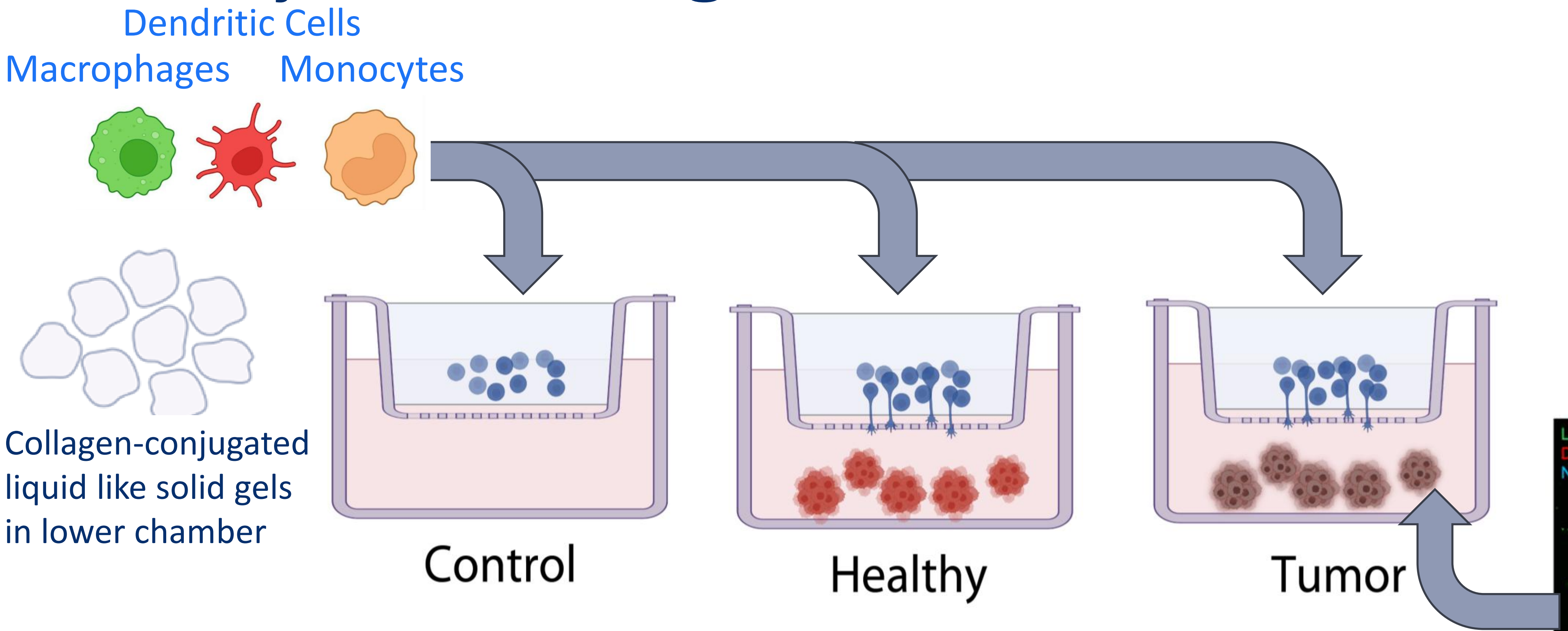
No immune cells

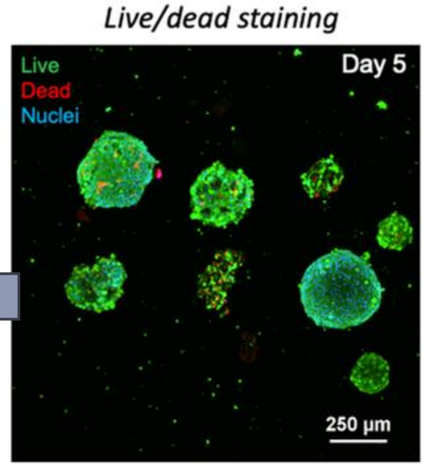


Dendritic Cells
Macrophages
Monocytes

4T1 mammary carcinoma explants

In vitro myeloid cell migration

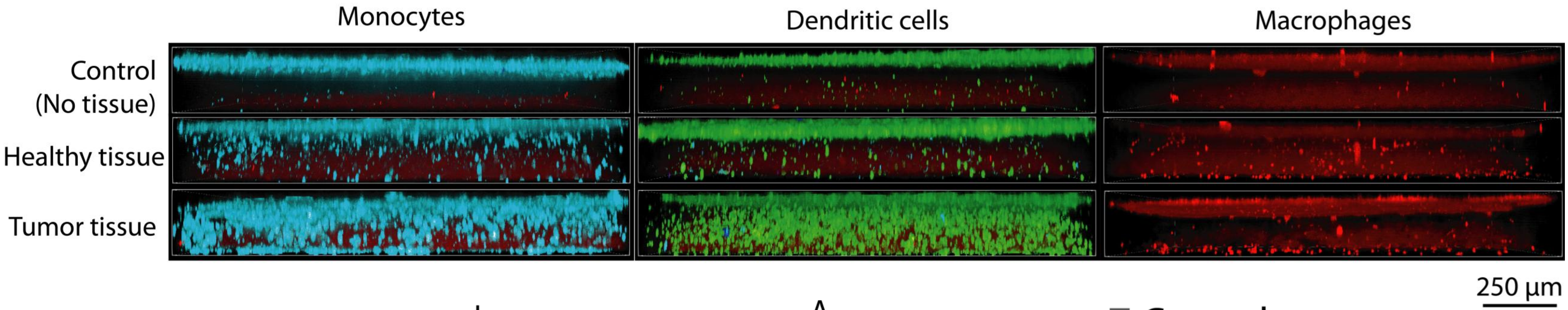


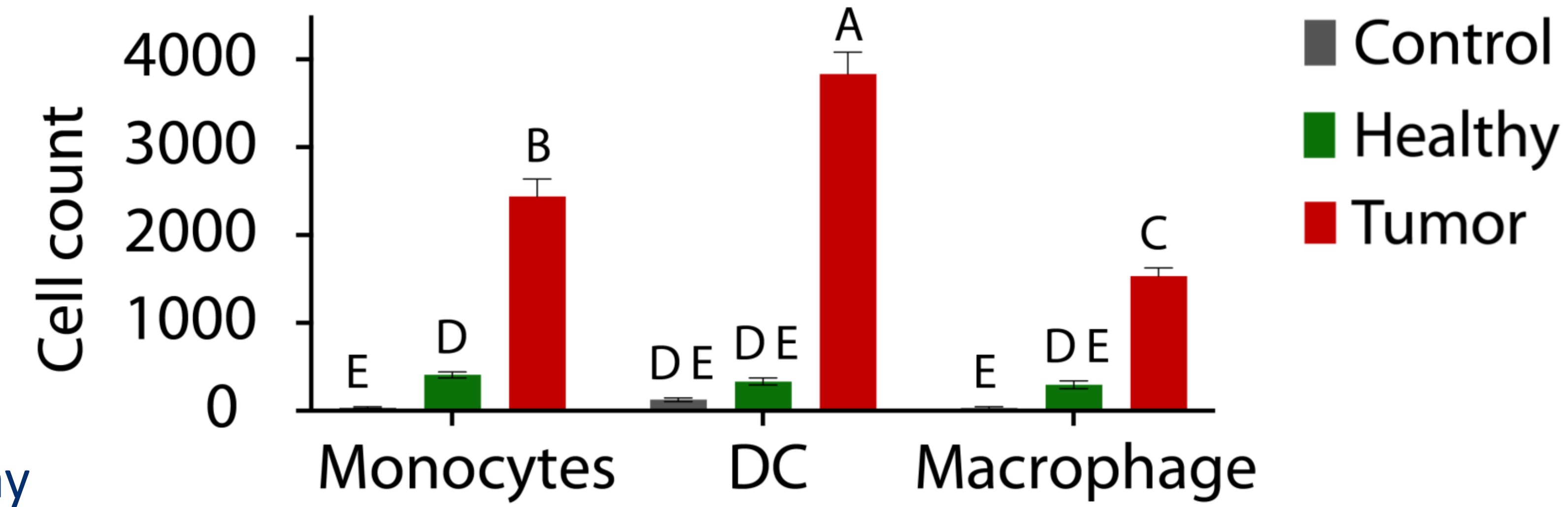


24 h migration assay

4T1 mammary carcinoma explants

In vitro myeloid cell migration





24 h migration assay

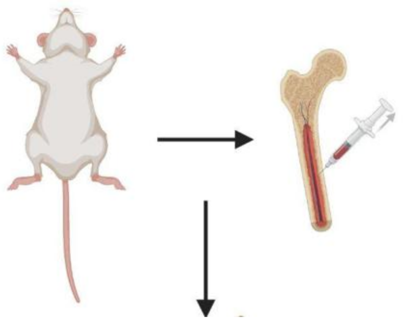
Groups that share a letter don't show significant difference (P<0.05)

4T1 explants

Dendritic cells > Monocytes > Macrophages in terms of migration towards tumor

In vivo myeloid cell migration

Bone marrow extraction

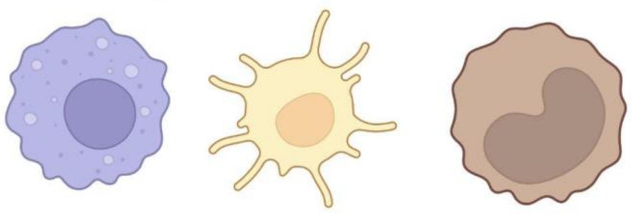


Cell differentiation

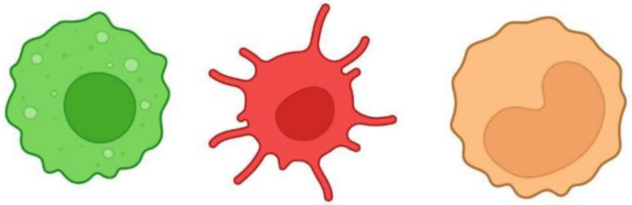
Dendritic Cells

Macrophages

Monocytes

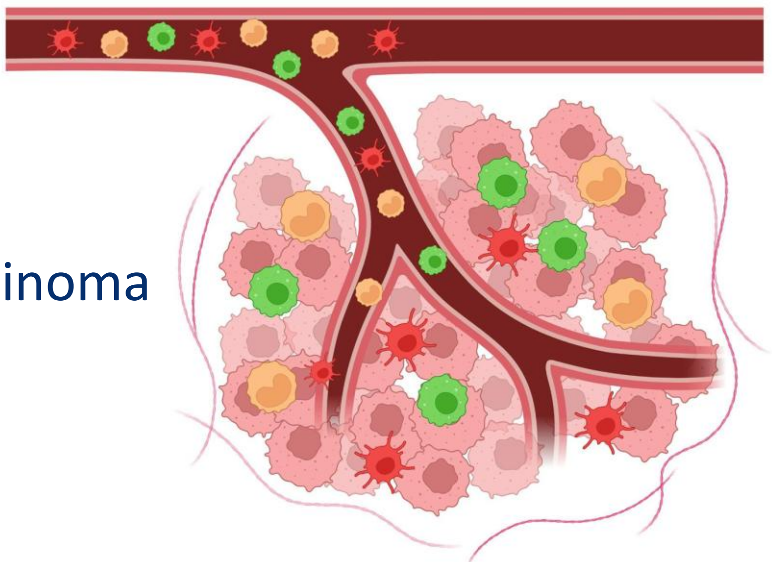


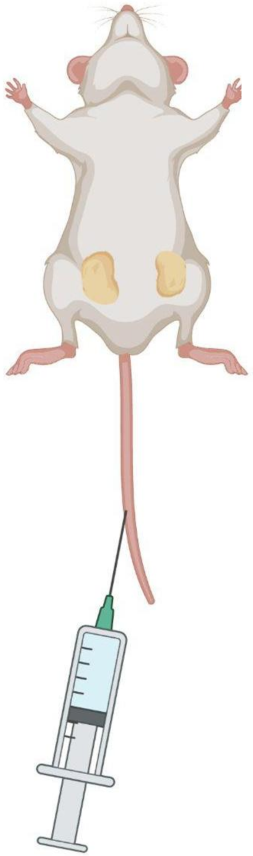
Cell labelling (fluorescent dye)

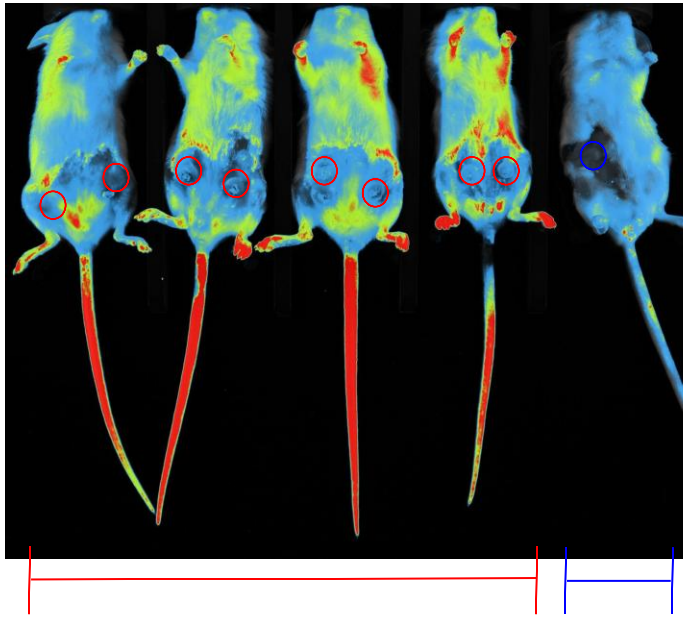


IV injection

4T1 mammary carcinoma
BALB/c mice





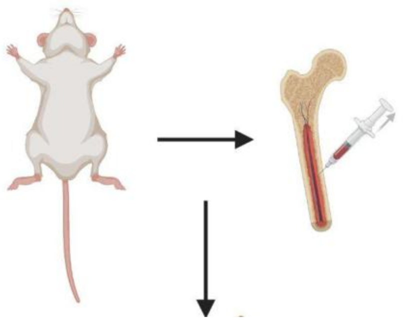


Myeloid Cell Injection

No cells

In vivo myeloid cell migration

Bone marrow extraction

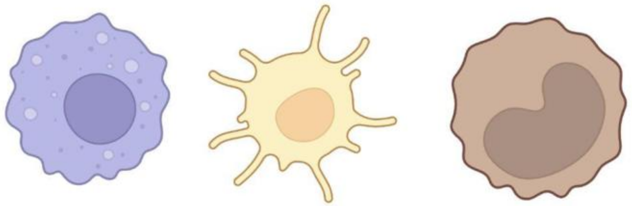


Cell differentiation

Dendritic Cells

Macrophages

Monocytes



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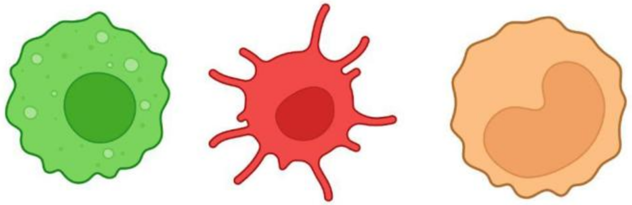
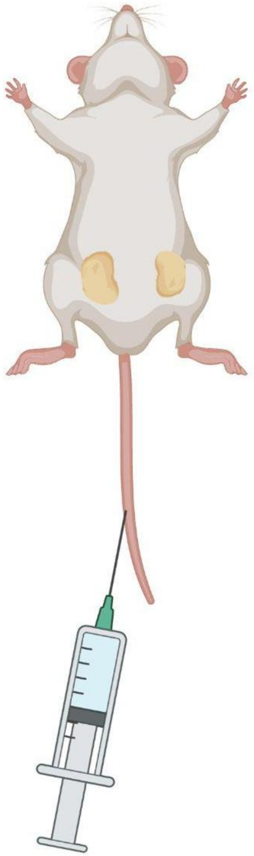
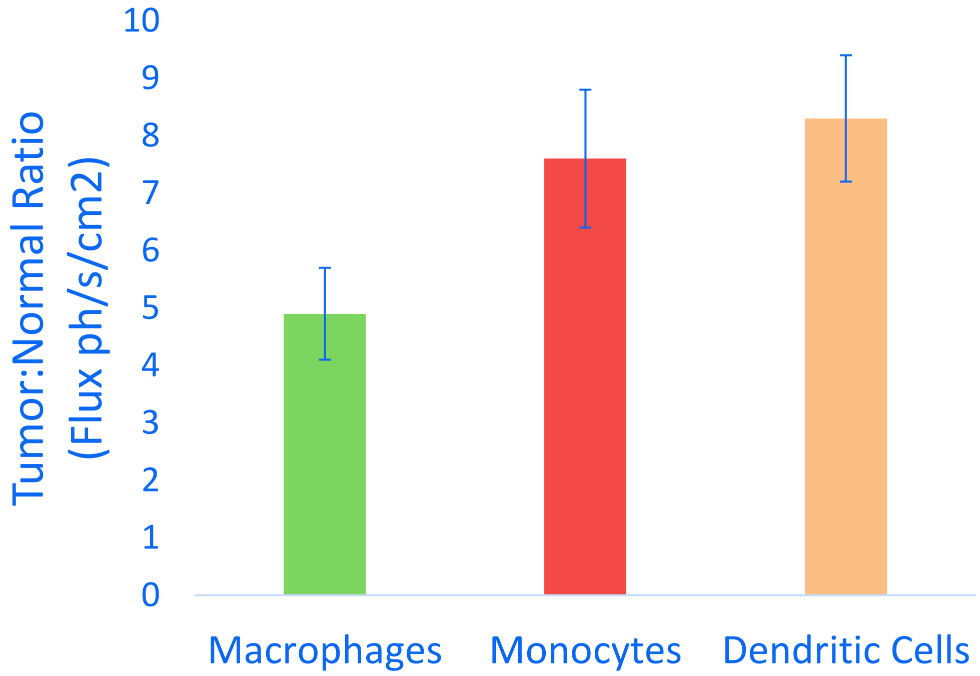


IV injection

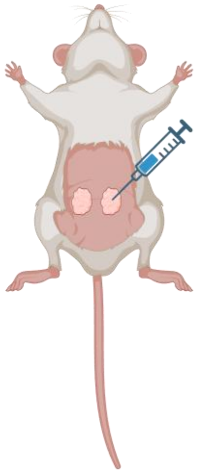
4T1 mammary carcinoma
BALB/c mice





In vivo myeloid cell migration

Day 0

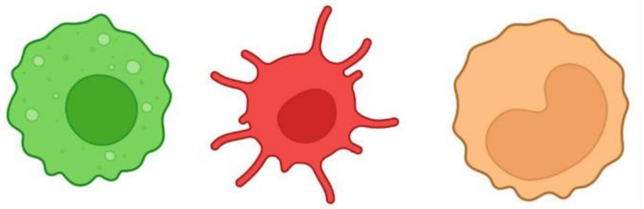


Day 2

Dendritic Cells

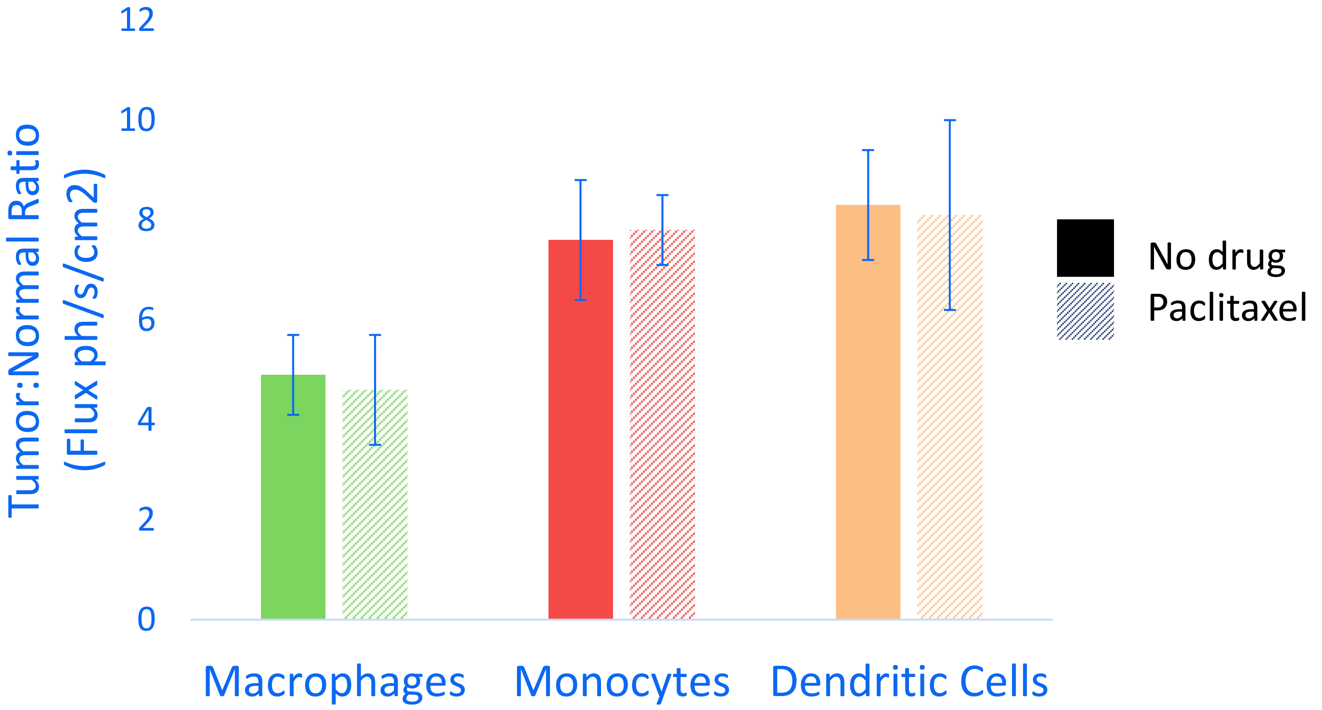
Macrophages

Monocytes



Day 4

Sacrifice, resect, image



4T1 mammary carcinoma
BALB/c mice

Acknowledgements

Dunne Lab

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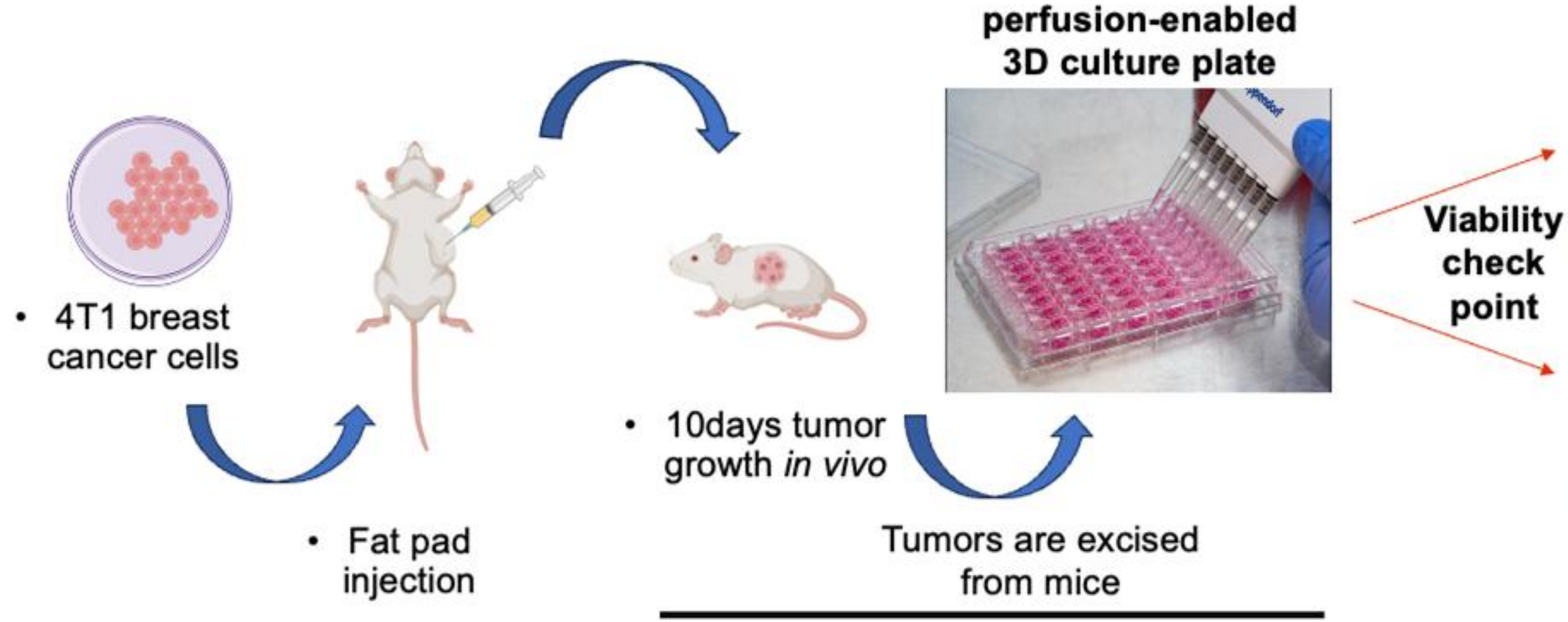
Diego Pedro
Ryan Smolchek
Jose Serrano-Velez

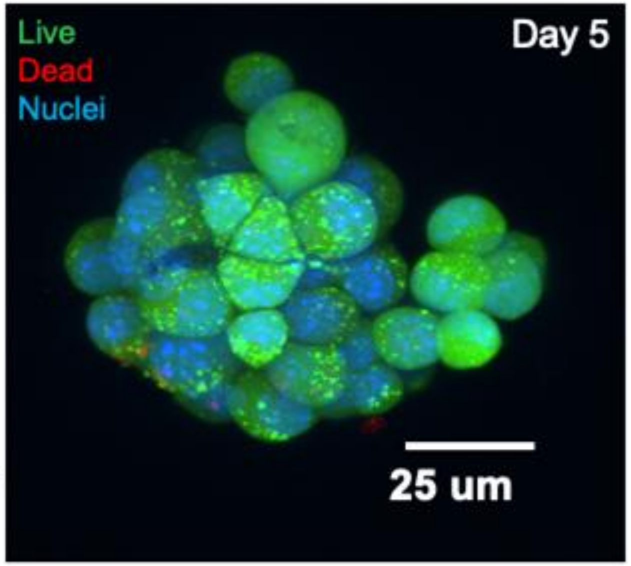
Paulo Rodriguez
Rachel Jimenez
Ken Tsai
Elsa Flores
Issam El Naqa
Gilmer Valdes

David Odde
Roberto Alonso-Matilla

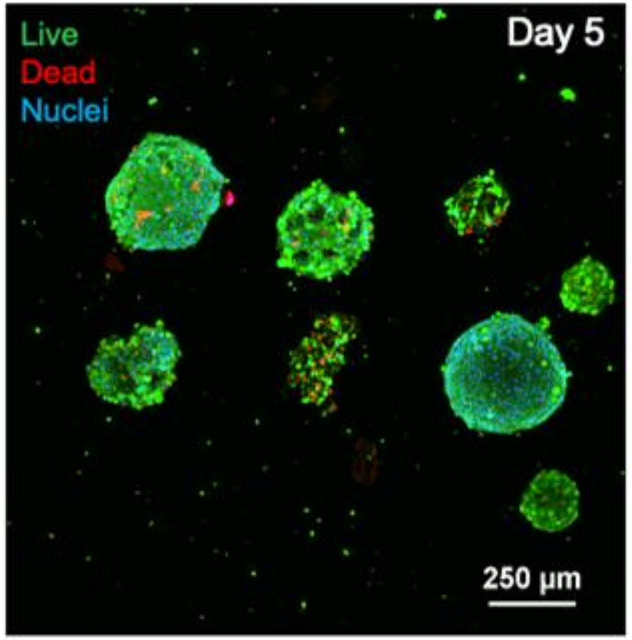
Neda Latifi
Mark Jaroszewski

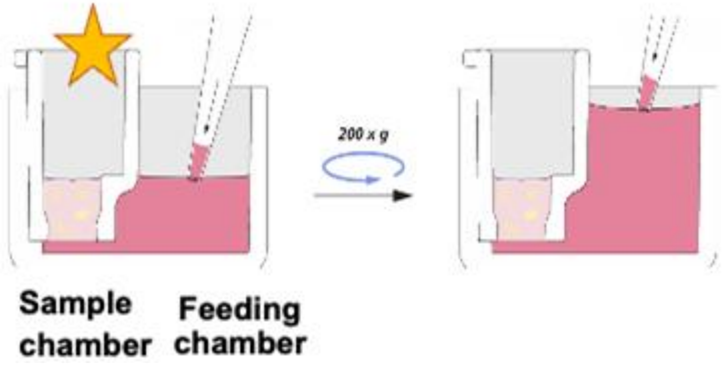
Myeloid Cell Trafficking – *In Vitro*





Live/dead staining

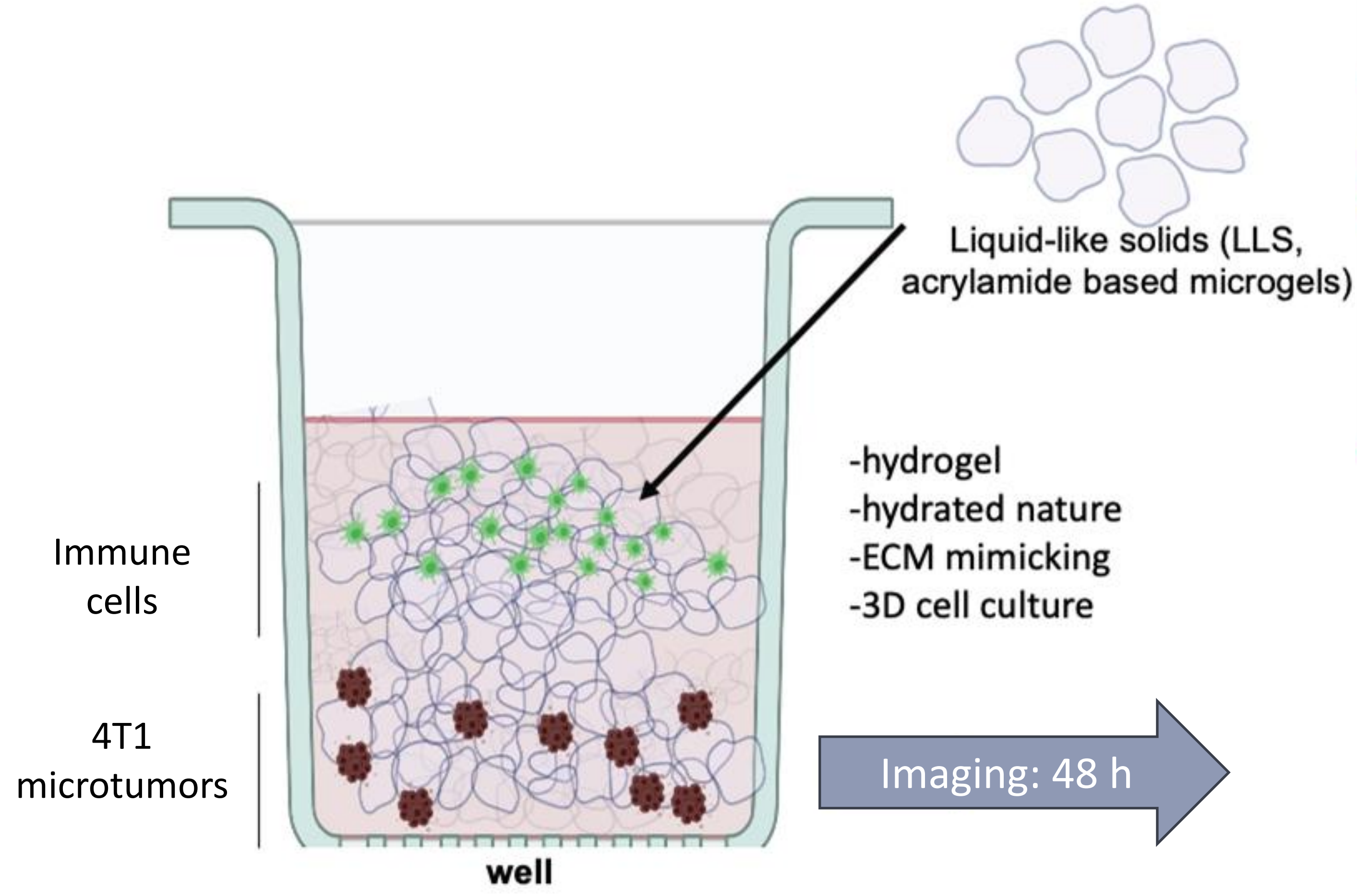


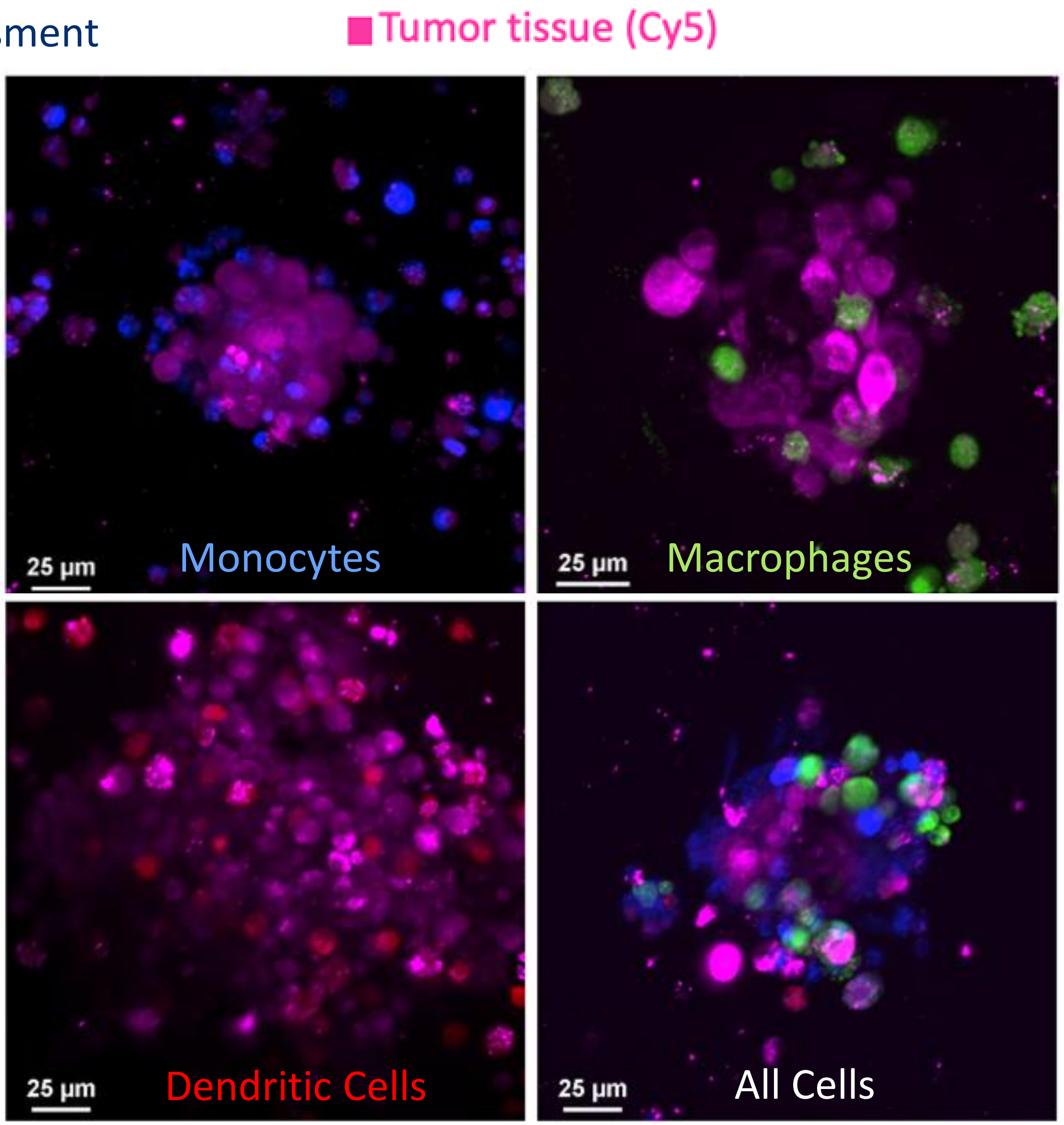


<u>Tumor processing for *in vitro* culture:</u>
-chopped
-homogenized
-no enzyme
-media changed every 24h

Myeloid Cell Trafficking – *In Vitro*

Immune Cell Infiltration into Melanoma Spheroids: Co-Culture Assessment





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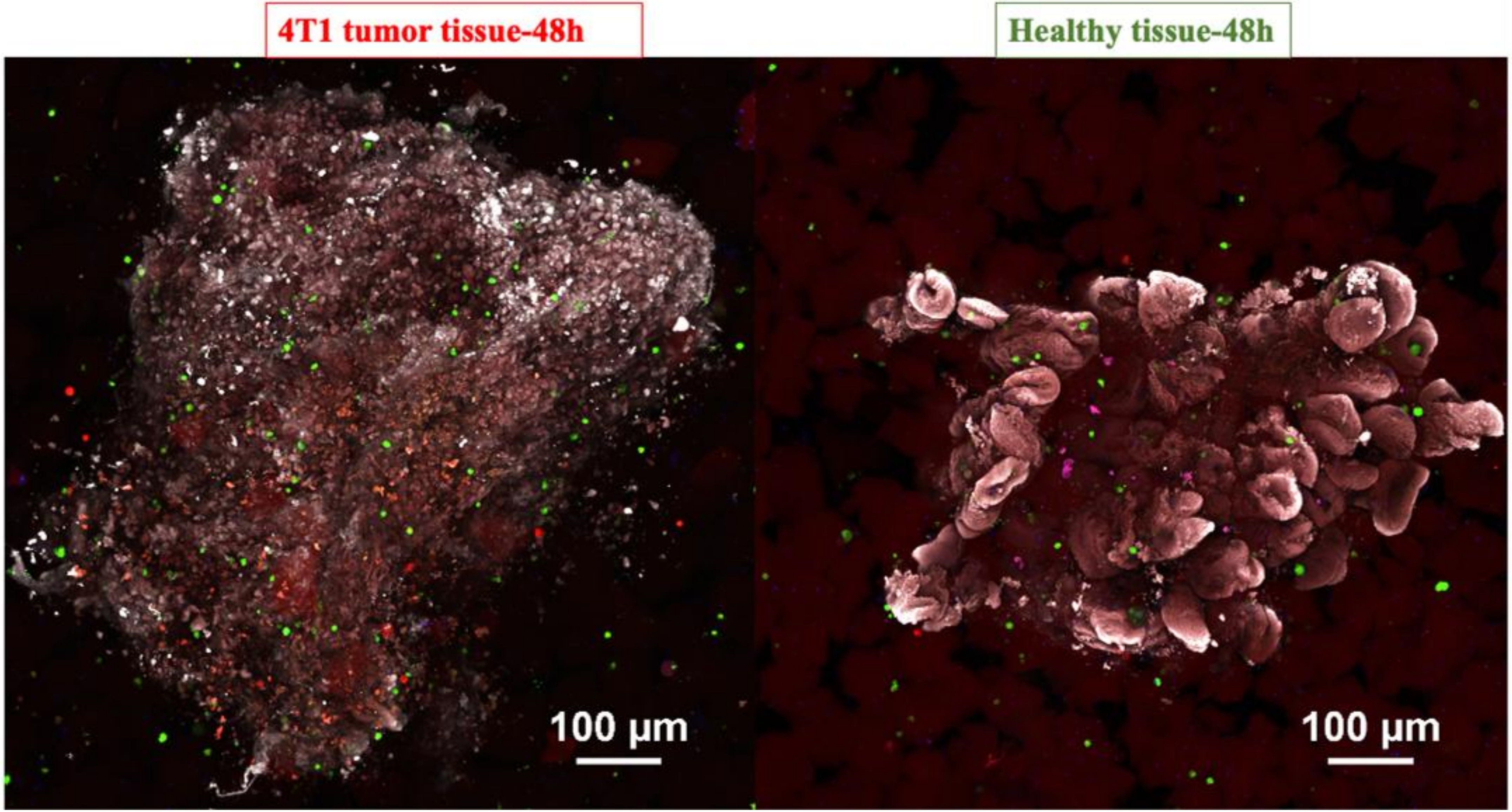

deep red: tumor

red: macrophages

green: DCs

Blue: monocytes