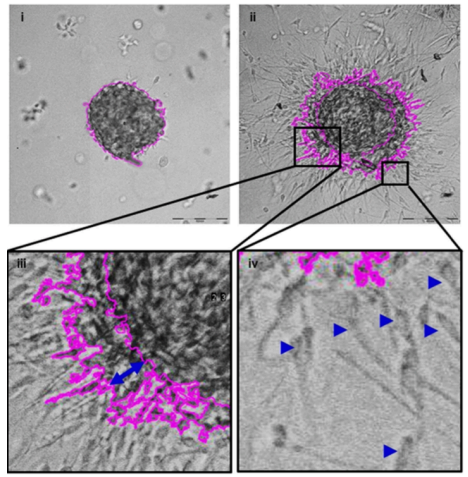
PROJECT TITLE:

INVESTIGATING THE DYNAMICS OF RESISTANCE TO CHEMOTHERAPY IN CANCER USING EXPERIMENTAL AND COMPUTATIONAL APPROACHES



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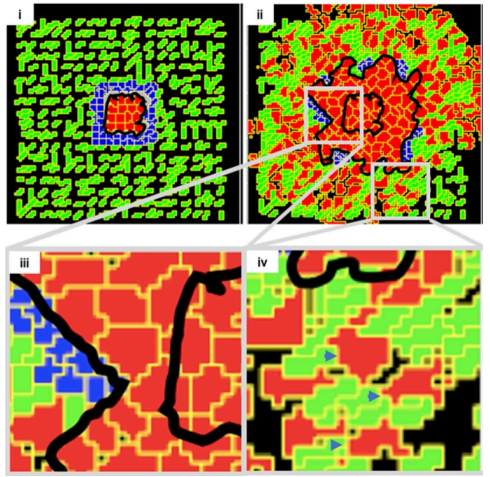
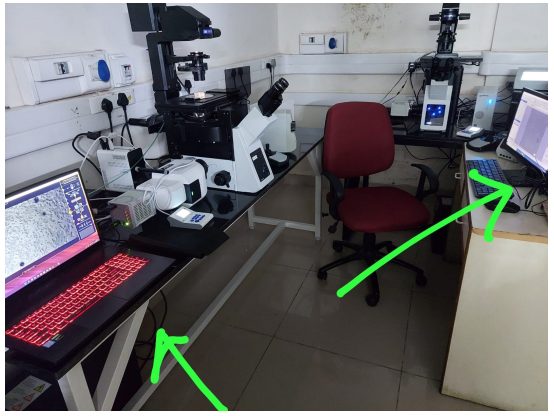


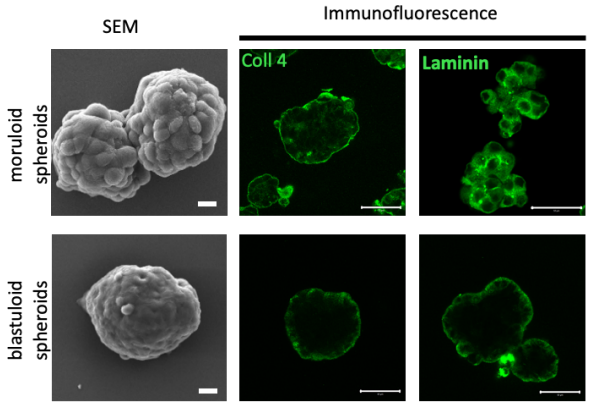
PROJECT QUESTION: Do spatial ordering of tumor cell populations and their cooperativity-competition dynamics explain resistance to chemotherapeutics? How does the architecture and mechanical properties of the tumor microenvironment influence chemoresistance?

LEARNING OPPORTUNITIES FOR THE PROSPECTIVE STUDENTS

EXPERIMENTAL

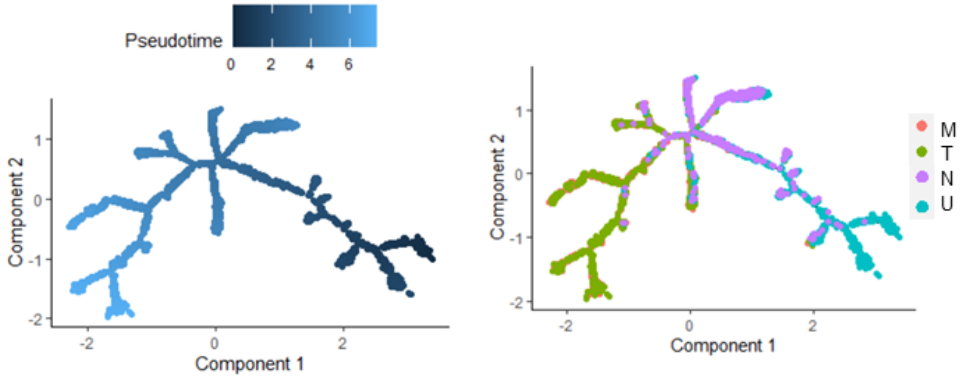
2D and 3D cultures
Organoid and tumoroid cultures
Confocal and epifluorescent microscopy
Time lapse imaging
Electron microscopy
Molecular cloning and cell biological assays
Animal experiments
Interface with clinicians





COMPUTATIONAL/THEORETICAL

Computational modeling of regulatory networks
Nonlinear dynamics
Multi-scale spatiotemporal modeling
Population dynamics/ecological modeling
Single-cell RNA-seq data analysis
Inferring cell-state transition trajectories
Spatial transcriptomic data analysis
Interface with clinicians



EXISTENT PROGRESS IN COLLABORATION

Contents lists available at ScienceDirect

Journal of Theoretical Biology

journal homepage: www.elsevier.com/locate/yjtbi

Matrix adhesion and remodeling diversifies modes of cancer invasion across spatial scales

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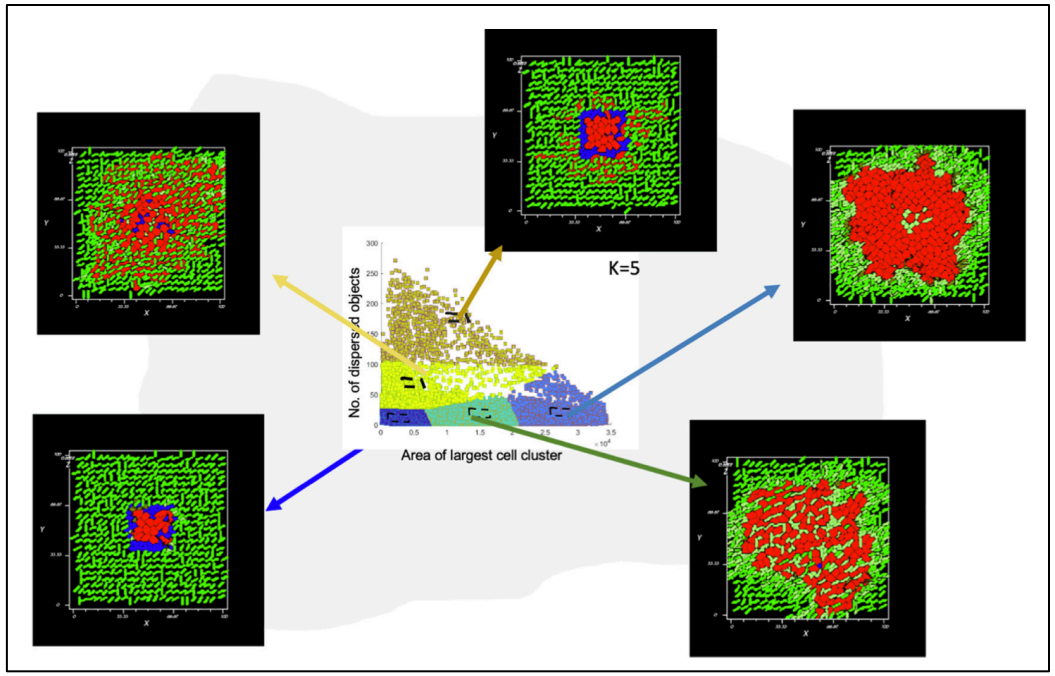
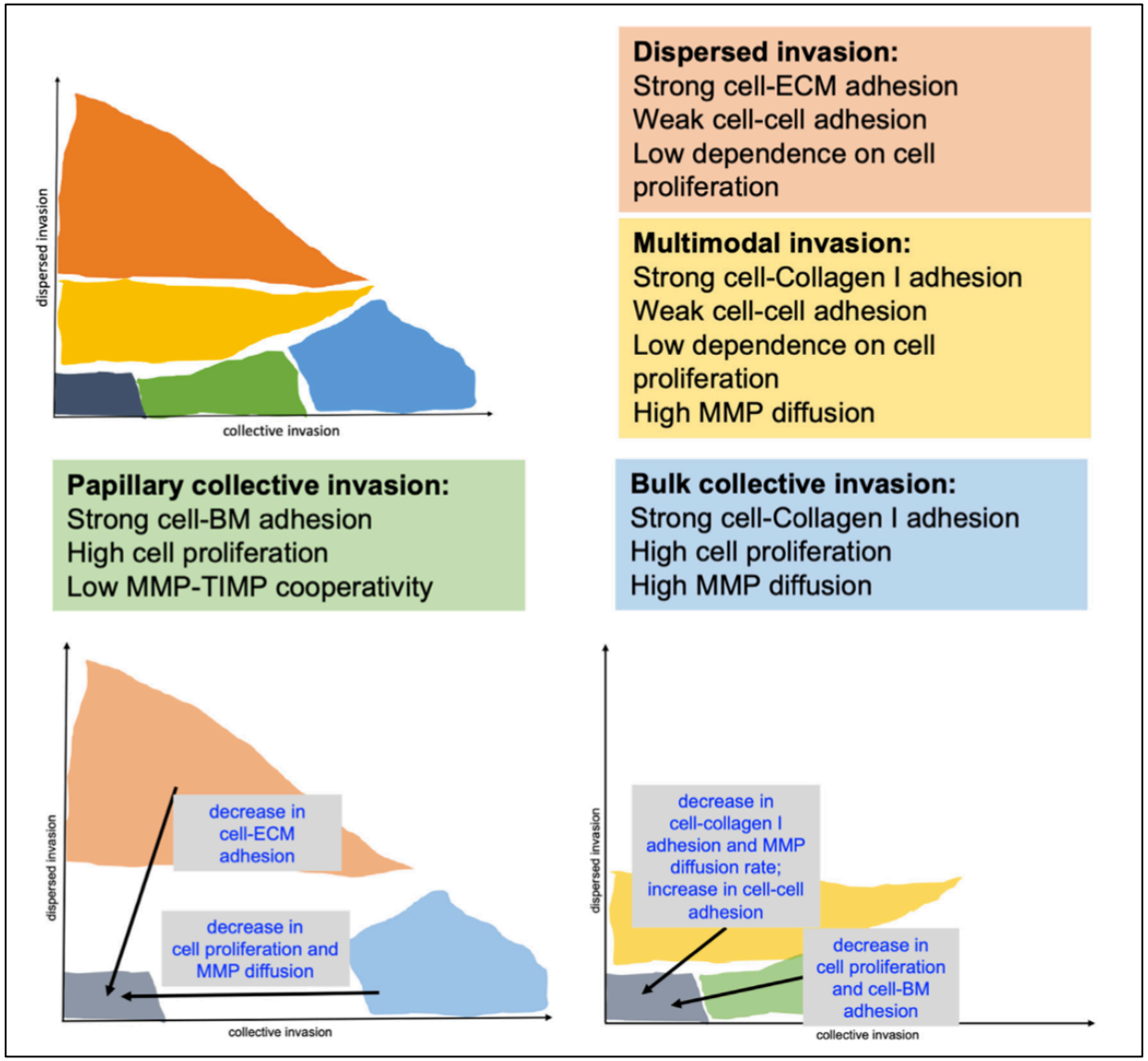




RELEVANT PROGRESS FROM THE EXPERIMENTAL GROUP

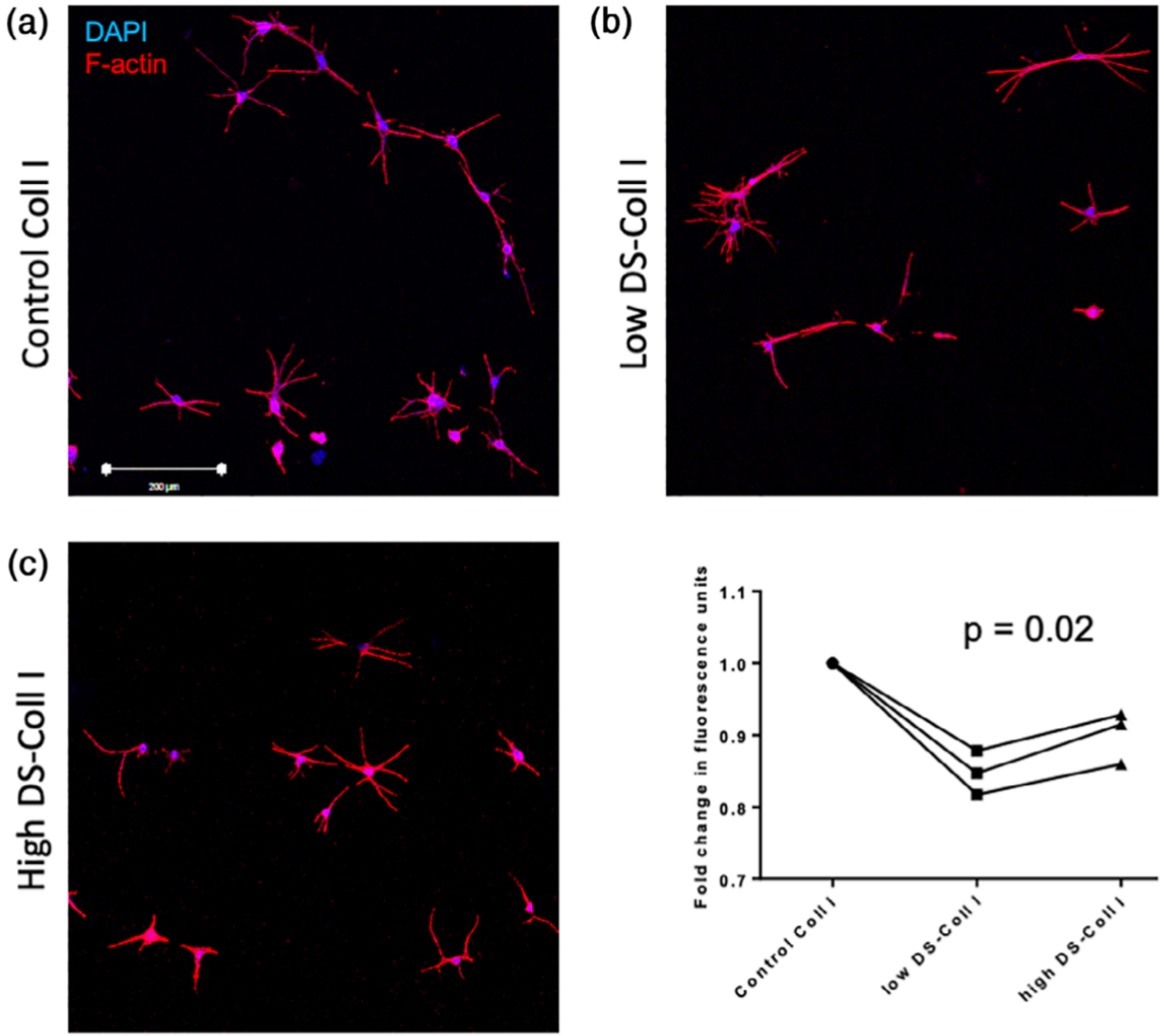
Received: 19 July 2020 | Revised: 31 January 2021 | Accepted: 10 February 2021
DOI: 10.1002/jbm.a.37160

ORIGINAL ARTICLE

A biphasic response of polymerized Type 1 collagen architectures to dermatan sulfate

Konkada Manattayil Jyothsna[1] | Purba Sarkar[2] | Keshav Kumar Jha[1,3] | Lal Krishna A. S.[1] | Varun Raghunathan[1] | Ramray Bhat[2]

Demonstration of reactivity of cancer cell interactions to varying ECM architectures



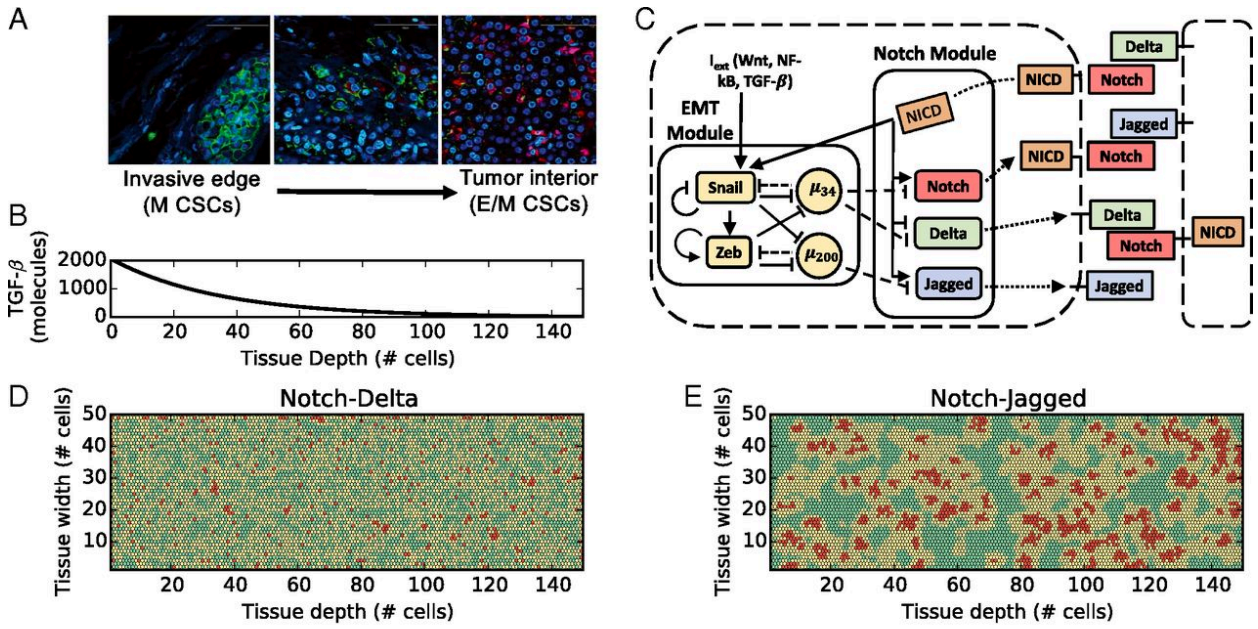
RELEVANT PROGRESS FROM THE COMPUTATIONAL GROUP

PNAS

Toward understanding cancer stem cell heterogeneity in the tumor microenvironment

Federico Bocci[a,b,1], Larisa Gearhart-Serna[c,1], Marcelo Boareto[d,e], Mariana Ribeiro[c], Eshel Ben-Jacob[a,2], Gayathri R. Devi[c,f,3], Herbert Levine[a,g,h,3,4], José Nelson Onuchic[a,b,h,i,3], and Mohit Kumar Jolly[a,3,5]

[a]Center for Theoretical Biological Physics, Rice University, Houston, TX 77005; [b]Department of Chemistry, Rice University, Houston, TX 77005; [c]Department of Surgery, Division of Surgical Sciences, Duke University School of Medicine, Durham, NC 27710; [d]Department of Biosystems Science and Engineering, ETH Zurich, 4058 Basel, Switzerland; [e]Swiss Institute of Bioinformatics, 1015 Lausanne, Switzerland; [f]Women's Cancer Program, Duke Cancer Institute, Durham, NC 27710; [g]Department of Bioengineering, Rice University, Houston, TX 77005; [h]Department of Physics and Astronomy, Rice University, Houston, TX 77005; and [i]Department of Biosciences, Rice University, Houston, TX 77005



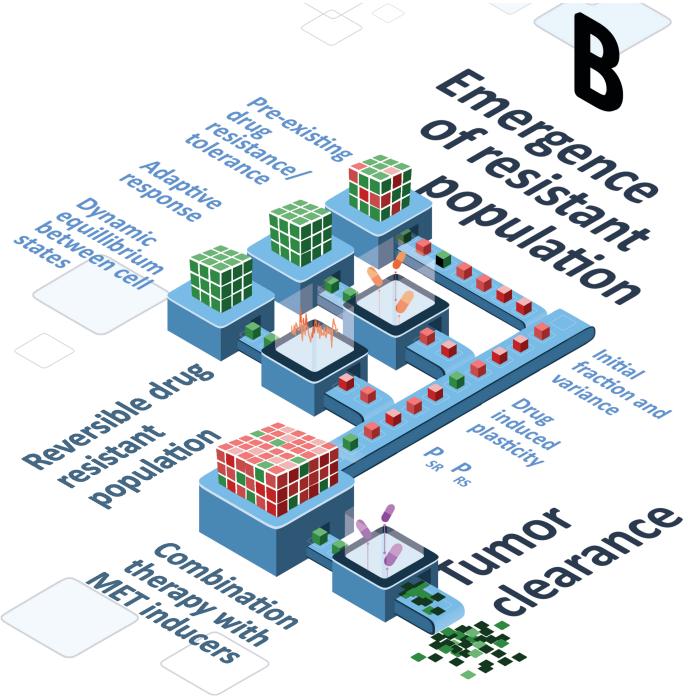
Multi-scale models to explain spatial patterns of cancer cell heterogeneity

Published online 9 July 2021

NAR Cancer, 2021, Vol. 3, No. 3 1
https://doi.org/10.1093/narcan/zcab027

A mechanistic model captures the emergence and implications of non-genetic heterogeneity and reversible drug resistance in ER+ breast cancer cells

Sarthak Sahoo[1,2], Ashutosh Mishra[1,2,†], Harsimran Kaur[1,†], Kishore Hari[1], Srinath Muralidharan[3], Susmita Mandal[1] and Mohit Kumar Jolly[1,*]



Combinatorial therapies to tackle side-effects of drug-induced switch to a resistant state