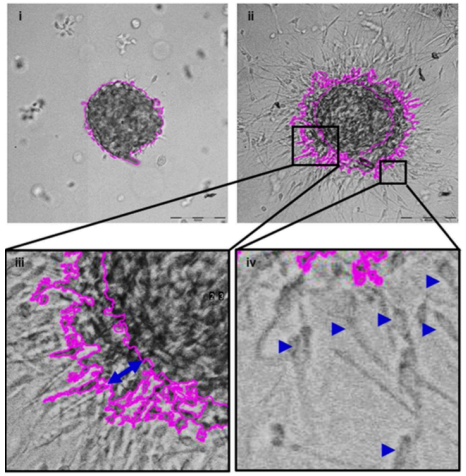
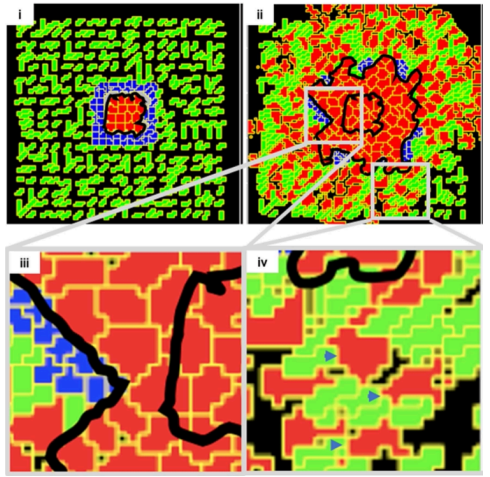
**PROJECT TITLE:**

# A SYSTEMS BIOLOGICAL APPROACH TO CANCER METASTASIS USING INTEGRATED EXPERIMENTAL-COMPUTATIONAL APPROACHES




SUPERVISORS:
Ramray Bhat
(Molecular Reproduction, Development and Genetics)
Mohit Kumar Jolly
(Centre for BioSystems Science and Engineering)

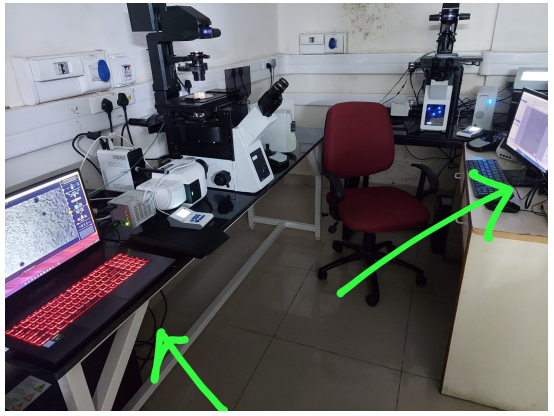


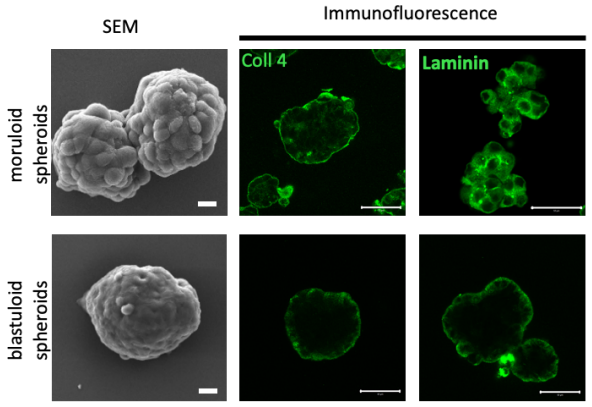

**PROJECT QUESTION:** How do molecular signaling circuits within cancer cells interact with each other to drive specific modes of metastasis (single cell/collective) as well as allow cells to transit between each other?

# LEARNING OPPORTUNITIES FOR THE PROSPECTIVE STUDENTS

## EXPERIMENTAL

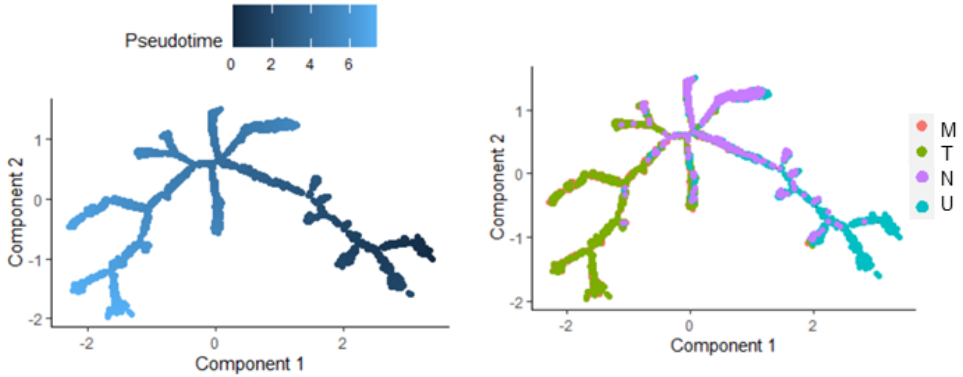
2D and 3D cultures
Organoid and tumoroid cultures
Confocal and epifluorescent microscopy
Time lapse imaging
Electron microscopy
Molecular cloning and cell biological assays
Animal experiments
Interface with clinicians






## COMPUTATIONAL/THEORETICAL

Computational modeling of regulatory networks
Nonlinear dynamics
ODE based & Boolean modeling
Multi-scale spatiotemporal modeling
Cellular Potts framework
Single-cell RNA-seq data analysis
Inferring cell-state transition trajectories
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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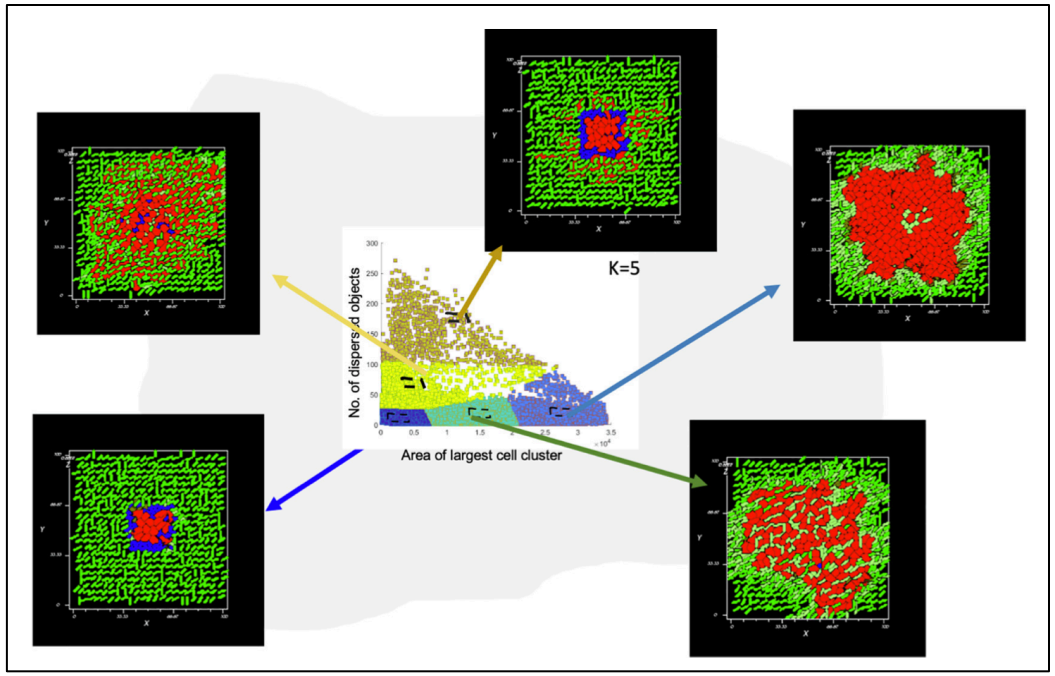
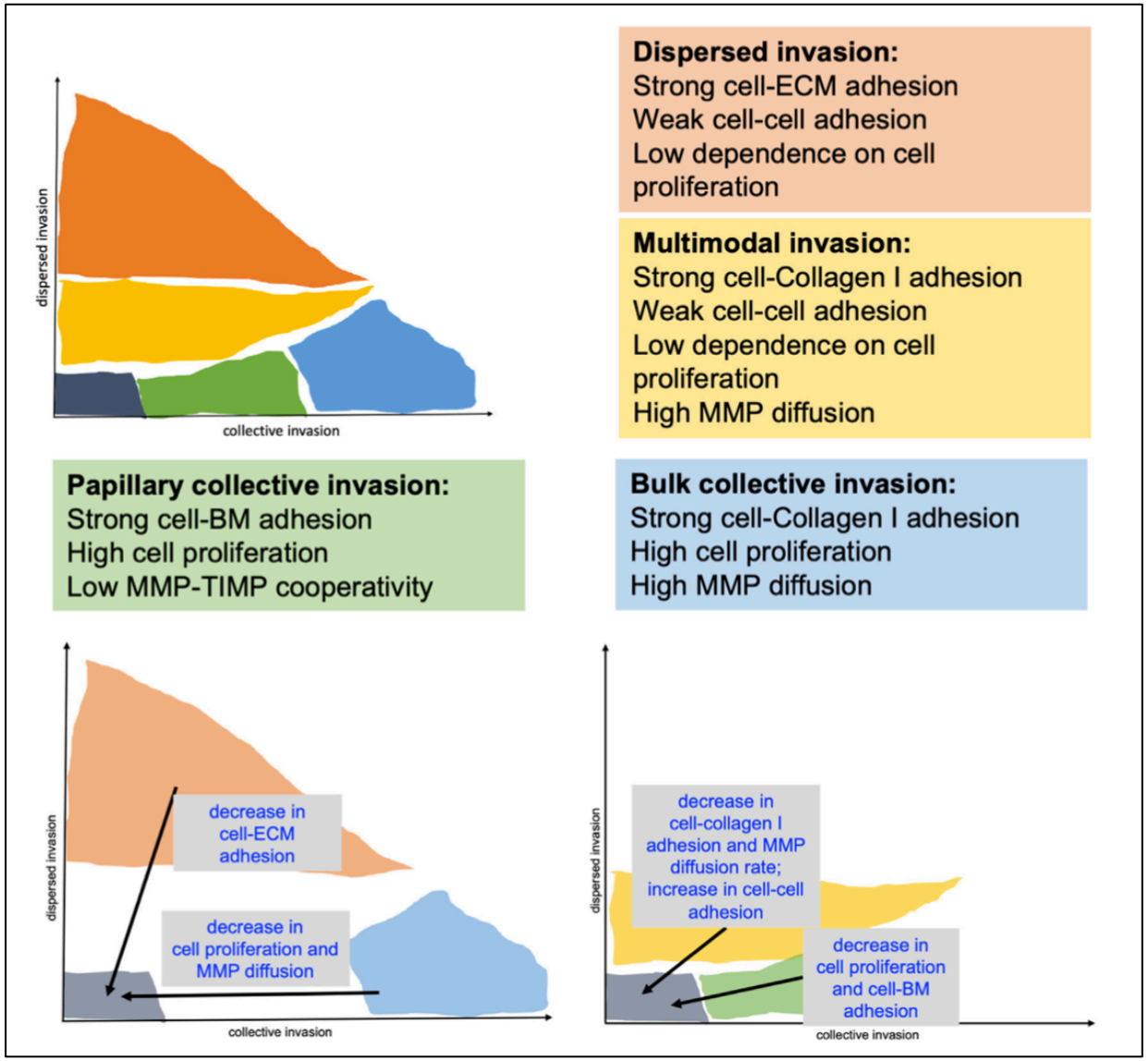


# RELEVANT PROGRESS FROM THE EXPERIMENTAL GROUP

ACS central science

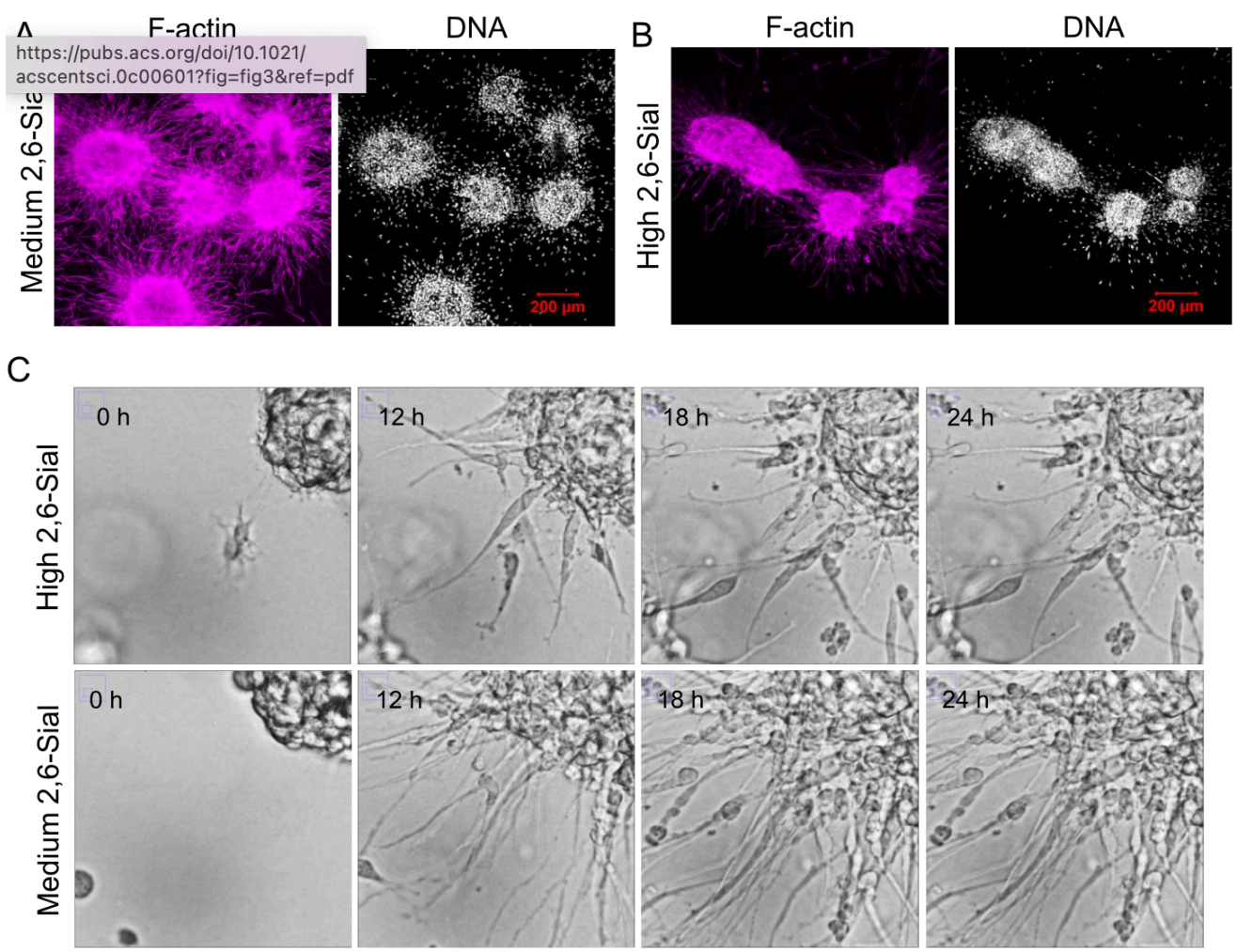
ACS AUTHORCHOICE

http://pubs.acs.org/journal/acscii Research Article

**Heterogeneity in 2,6-Linked Sialic Acids Potentiates Invasion of Breast Cancer Epithelia**

Dharma Pally, Durjay Pramanik, Shahid Hussain, Shreya Verma, Anagha Srinivas, Rekha V. Kumar, Arun Everest-Dass, and Ramray Bhat*

Demonstration of cancer heterogeneity driving invasion



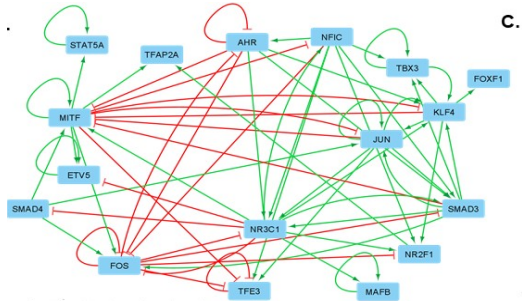
# RELEVANT PROGRESS FROM THE COMPUTATIONAL GROUP

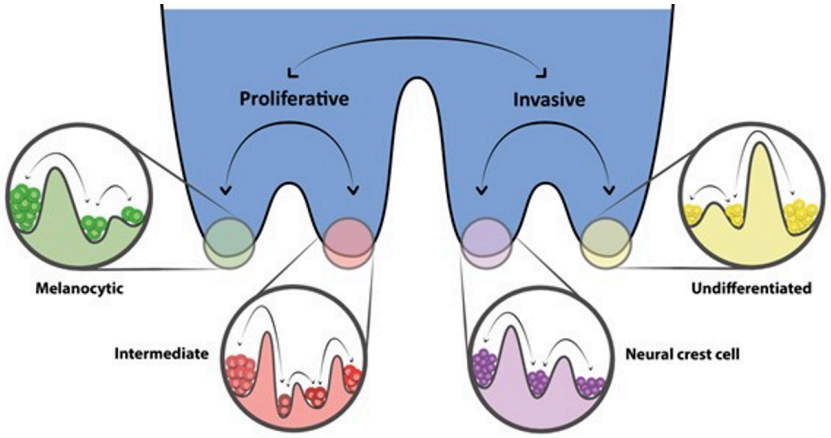
iScience

CellPress
OPEN ACCESS

Article

Systems-level network modeling deciphers the master regulators of phenotypic plasticity and heterogeneity in melanoma



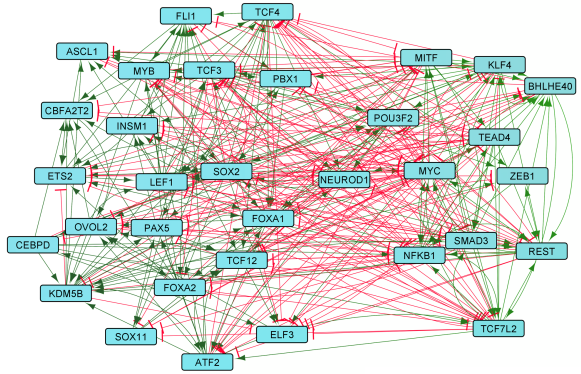




eLife

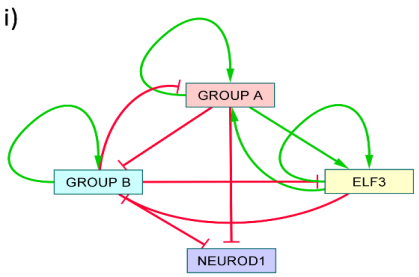
RESEARCH ARTICLE

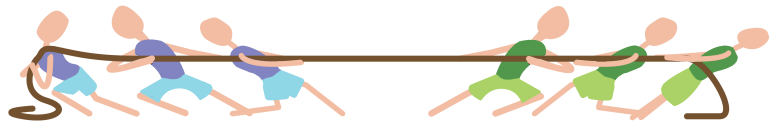
**Topological signatures in regulatory network enable phenotypic heterogeneity in small cell lung cancer**

Lakshya Chauhan[1,2†], Uday Ram[1,2†], Kishore Hari[1], Mohit Kumar Jolly[1*]




Network reduction



Identifying regulatory networks underlying different phenotypes and switching among them in lung cancer, melanoma

Deciphering design principles of these regulatory networks