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The Physics of Collective Cell Migration

January 15-17, 2020
PCTS Seminar Room
Jadwin Hall, Fourth Floor, Room 407

Program Organizers
Ricard Alert
Daniel Cohen
Celeste Nelson
Ned Wingreen

Co-sponsored by the Princeton University School of Engineering and Applied Science, the Chemical and Biological Engineering Department, the Mechanical and Aerospace Engineering Department, and the Lewis-Sigler Institute for Integrative Genomics
# The Physics of Collective Cell Migration

**Wednesday, January 15, 2020**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:45-9:20</td>
<td>Continental Breakfast</td>
</tr>
<tr>
<td>9:20-9:30</td>
<td>Welcome/Introduction</td>
</tr>
<tr>
<td>9:30-10:05</td>
<td>Going in circles gets you somewhere – signaling mechanisms that coordinate cell movements for epithelial migration. <em>Sally Horne-Badovinac, University of Chicago</em></td>
</tr>
<tr>
<td>10:05-10:40</td>
<td>Connecting signaling dynamics to collective migration across multicellular systems. <em>Allyson Sgro, Boston University</em></td>
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<tr>
<td>10:40-11:10</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:10-11:45</td>
<td>Jamming-unjamming transitions in cancer cells in 3D environments. <em>Peter Friedl, Radboud University</em></td>
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<tr>
<td>11:45-12:00</td>
<td>Collective gradient sensing: cell-to-cell variability and cell specialization. <em>Brian Camley, John Hopkins University</em></td>
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<tr>
<td>12:00-12:15</td>
<td>Predicting space invasion by polarized cells. <em>Christophe Deroulers, Université Paris Diderot</em></td>
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<tr>
<td>12:15-2:00</td>
<td>Lunch at PCTS</td>
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<tr>
<td>2:00-2:35</td>
<td>Cell sorting and coordinated migration in epithelial cells. <em>Benoit Ladoux, Université Paris Diderot</em></td>
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<tr>
<td>2:35-3:10</td>
<td>From active media to smart matter: the role of signaling in collective cell motility. <em>Herbert Levine, Northeastern University</em></td>
</tr>
<tr>
<td>3:10-3:40</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>3:40-4:15</td>
<td>Bioelectric sheepdogs to herd and control collective cell migration. <em>Daniel Cohen, Princeton University</em></td>
</tr>
<tr>
<td>4:15-4:30</td>
<td>Hydrodynamic approach to spreading epithelia. Active wetting and fingering. <em>Jaume Casademunt, University of Barcelona</em></td>
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</table>

**Wednesday, January 15, 2020 (cont.)**

<table>
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<tbody>
<tr>
<td>4:30-4:45</td>
<td>A particle-field representation unifies paradigms in active matter. <em>Robert Großmann, University of Potsdam</em></td>
</tr>
<tr>
<td>4:45-5:30</td>
<td>Poster flash talks. <em>All poster presenters</em></td>
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<tr>
<td>5:30</td>
<td>Poster Session and Reception at PCTS</td>
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**Thursday, January 16, 2020**

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<tr>
<td>8:30-9:00</td>
<td>Continental Breakfast</td>
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<tr>
<td>9:00-9:35</td>
<td>Survival by collective pattern formation in the motile bacterium <em>Myxococcus xanthus</em>. <em>Joshua Shaevitz, Princeton University</em></td>
</tr>
<tr>
<td>9:35-10:10</td>
<td>Topological defects induce layer formation in bacterial colonies. <em>Ricard Alert, Princeton University</em></td>
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<tr>
<td>10:10-10:40</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>10:40-11:15</td>
<td>Uncovering the mechanisms of self-organization behaviors in Myxobacteria biofilms. <em>Oleg Igoshin, Rice University</em></td>
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<tr>
<td>11:15-11:30</td>
<td>Collective migration of bacteria in disordered media. <em>Topomoy Battacharjee, Princeton University</em></td>
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<tr>
<td>11:30-11:45</td>
<td>Growth and form in population dynamics: mapping transitions in growing colonies. <em>Alexander Golden, Boston University</em></td>
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<tr>
<td>11:45-1:15</td>
<td>Lunch at PCTS and Breakout Discussions</td>
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<tr>
<td>1:15-2:00</td>
<td>Reports on the Breakout Discussion Sessions</td>
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<tr>
<td>2:00-2:35</td>
<td>Tissue crosstalk during collective migration in developing organs. <em>Celeste Nelson, Princeton University</em></td>
</tr>
<tr>
<td>2:35-3:10</td>
<td>Melting and defects in phase field models of epithelia. <em>Cristina Marchetti, Univ. California Santa Barbara</em></td>
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</tbody>
</table>
The Physics of Collective Cell Migration

Thursday, January 16, 2020 (cont.)

3:10-3:40     Coffee Break

3:40-4:15 How to launch a wave of epithelial unjamming. And how to quench it
Jeffrey Fredberg, Harvard University

4:15-4:30 Large-scale mixing and small-scale demixing in confluent biological tissues
Preeti Sahu, Syracuse University

4:30-4:45 Trawctions and stress fibers control cell shape and rearrangements in collective cell migration
Jacob Notbohm, University of Wisconsin-Madison

4:45-6:15     Poster Session at PCTS

Friday, January 17, 2020 (cont.)

11:45-12:00 Retinoic acid induces the formation of hemispherical domes from two-dimensional cell monolayers
Peter Galie, Rowan University

12:00-12:10 Closing remarks

12:10-2:00     Lunch at PCTS

Friday, January 17, 2020

8:30-9:00     Continental Breakfast

9:00-9:35 Modelling the dynamics of cell layers
Julia Yeomans, University of Oxford

9:35-10:10 3D printing cell populations for studying collective behavior in 3D
Thomas Angelini, University of Florida

10:10-10:40 Coffee break

10:40-11:15 Instabilities and topological defects loops in 3D active nematics
Guillaume Duclos, Brandeis University

11:15-11:30 Disordered elastic systems theory as a framework to study collective cell migration
Nirvana Caballero, University of Geneva

11:30-11:45 Roughness and dynamics of proliferating cell fronts as a probe of cell-cell interactions
Guillaume Rapin, University of Geneva
The Physics of Collective Cell Migration

Poster session

Theoretical framework to describe traveling waves of bacteria in porous media
Daniel Amchin, Princeton University

Collective migration of bacteria in disordered media
Topomoy Battarcharjee, Princeton University

Disordered elastic systems theory as a framework to study collective cell migration
Nirvana Caballero, University of Geneva

Collective gradient sensing: cell-to-cell variability and cell specialization
Brian Camley, John Hopkins University

Modeling vortex formation in spreading epithelial monolayers
Otavio Canton, Princeton University

Topological defects in cell monolayers guided by topography
Kirsten Endresen, John Hopkins University

Mono- to multilayer transition in Myxococcus xanthus bacterial colonies
Chenyi Fei, Princeton University

Growth and form in population dynamics: mapping transitions in growing colonies
Alexander Golden, Boston University

Cell identities and rearrangements in the embryonic pulmonary mesenchyme
Katie Goodwin, Princeton University

Modeling the effect of vimentin on confined cell motility
Sarthak Gupta, Syracuse University

Tissue-tissue interactions at boundaries of colliding growing monolayers of varying size, shape, and cell density
Matt Heinrich, Princeton University

Collective dynamics of biomimetic run-and-turn microswimmers
Hamid Karani, Northwestern University

Morphogen gradients inside active confluent tissue
Elisabeth Lawson-Keister, Syracuse University

Obesity-associated Adipose Stromal Cells Promote Breast Cancer Cell Invasion Through Direct Cell Contact and ECM Remodeling
Lu Ling, Cornell University

An active nematic fluid model of interfacial instabilities in Myxococcus xanthus biofilms
John McEnany, Princeton University

Mapping collagen fiber alignment in the developing mouse mammary gland
Bryan Nerger, Princeton University

Structural control of biofilm formation in porous media
Jenna Ott, Princeton University

Self-propelled particles with inhomogeneous speed
Sudipta Pattanayak, S N Bose National Center for Basic Sciences

Roughness and dynamics of proliferating cell fronts as a probe of cell-cell interactions
Guillaume Rapin, University of Geneva

Small-scale demixing in confluent cellular monolayers
Preeti Sahu, Syracuse University

Investigating cells shape changes in the zebrafish embryo using a 3D vertex model
Paula C Sanematsu, Syracuse University

3D growth dynamics of Myxococcus xanthus fruiting bodies
Cassidy Yang, Princeton University