

# QIN NI

2113 CHEMICAL AND NUCLEAR ENGINEERING BUILDING • COLLEGE PARK, MD 20742

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## RESEARCH INTERESTS

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Develop computational models to explore physical principles underlying active matters self-organization. Cytoskeleton dynamics, multiscale modeling, and non-equilibrium thermodynamics.

## EDUCATION

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**University of Maryland-College Park (UMD), MD, USA** *Dec. 2020 (Expected)*

- Ph.D. in Chemical Engineering (GPA:3.6/4.0, Advisor: Garegin A. Papoian)

**Rutgers University-New Brunswick, NJ, USA** *May 2015*

- B.S. in Chemical Engineering, Summa Cum Laude

**South China University of Technology (SCUT), Guangzhou, China** *June 2015*

- B.S. in Applied Chemistry (Dual degree program with Rutgers University)

## PUBLICATIONS

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(\*denotes equal contribution)

- Li, X<sup>\*</sup>; Ni, Q<sup>\*</sup>; He, X; Kong, J; Lim, SM; Papoian, GA; Trzeciakowski, JP; Trache, A; Jiang, Y. “Tensile Force Induced Cytoskeletal Reorganization: Mechanics Before Chemistry”. *PLOS Computational Biology*. Accepted.
- Ni, Q; Papoian, GA. “Turnover versus Treadmilling in Actin Network Assembly and Remodeling”. *Cytoskeleton*. 2019; 76: 562– 570.

(Papers in production)

- Vedula, P; Kurosaka, S; MacTaggart, B; Ni, Q; Papoian, GA; Jiang Y; Dong, D; Kashina, A. “Different translation dynamics of  $\beta$ - and  $\gamma$ -actin regulates cell migration”. *Submitted*.
- Ni, Q; Wagh, K; Upadhyaya, A; Papoian, GA. “Rapid treadmilling and myosin motors synergistically induce formation of cortex-like and ring-like actomyosin architectures”. *To be submitted*.
- Ni, Q; Floyd, C; Papoian, GA. “Actomyosin networks maximize mechanical dissipation by enhancing connectivity”. *In preparation*.

## RESEARCH EXPERIENCE

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**MEDYAN: Mechanochemical Modeling for Actin Matters** *Mar. 2015 - present*

- Co-developer of MEDYAN, an advanced and efficient computational models and software for mechanochemical simulations of active matters, particularly cytoskeletal networks (<http://medyan.org/>).

**Thermodynamic Principles Underlying Actin Network Self-organization** *Feb. 2020 - present*

- Explore how actin networks driven by myosin molecular motor (actomyosin) self-organize from disordered networks into higher-order structures via MEDYAN simulations.
- Discovered that mechanical free energy dissipation and filament displacement increase after actin network remodels, where dissipation and displacement spatially follow heavy-tailed distributions.

## RESEARCH EXPERIENCE CONTINUED

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### Actomyosin-Microtubule Dynamics Regulates Centrosome Reorientation

*Oct. 2019 - present*

- Investigate how steric interactions and crosslinking between microtubules and actomyosin regulate centrosome reorientation, an essential step of T-cell immune response.
- Develop comprehensive 3D centrosome - actomyosin computational model based on MEDYAN.

### Fundamental Mechanism underlying Actin Cortex Formation

*June 2017 - Sep. 2019*

- Explored the possible assembly mechanism of actin cortex, an actin polymer mesh that controls eukaryotic cell shape and mechanical function.
- Discovered a striking structure change from contractile actin clusters to cortex-like actin meshes upon facilitating actin filament assembly to living cell level, as supported by *in vivo* experiments.

### Active Reorganization of Actin Networks under Tensile Force

*Oct. 2017 – June 2019*

- Investigated external mechanical stimuli induced sub-cellular adaptation through actin networks.
- Proposed that actin network mechanically adapts to the external stimuli before a slower chemical self-organization driven by molecular motors, supported by observations from experimental collaborators.

### Treadmilling Dynamics of Branched Actin Networks

*Mar. 2016 - Sep. 2018*

- Explored the actin filament self-assembly dynamics, the treadmilling, with various regulatory proteins.
- Revealed that treadmilling quantified by the mostly used experimental method cannot represent the actual self-assembly dynamics of highly branched actin network.

## PRESENTATIONS AND POSTERS

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### Oral Presentation

- The Physics of Living Systems Student Research Network seminar. “Tensile Stress Induced Cytoskeletal Reorganization: Mechanics Before Chemistry”. University of Maryland, MD. *Oct. 2019*
- 2019 International Physics of Living Systems Research Network (iPoLS) annual meeting. “Rapid Treadmilling and Myosin Motors Synergistically Induce Formation of Cortex-Like and Ring-Like Actomyosin Architectures.” Munich, Germany. *July 2019*
- 11<sup>th</sup> Annual Q-bio Conference. “Turnover Dynamics of Dendritic Actin Networks in silico”. New Brunswick, NJ. *July 2017*
- UMD ResearchFest. “Turnover Dynamics of Dendritic Actin Networks in silico”. University of Maryland, MD. *June 2017*

### Posters

- 2020 iPoLS annual meeting. Online. *June 2020*
- American Society of Cell Biology 2019 annual meeting. Washington, D.C. *Dec. 2019*
- Biophysical Society 63<sup>rd</sup> annual meeting. Baltimore, MD. *Feb. 2019*
- UMD Biophysical Symposium. College Park, MD. *May 2017*
- NCI-UMD Symposium for Integrative Cancer Research. Bethesda, MD. *Feb. 2017*

## SELECTED AWARDS

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- Jan & Anneke Sengers Fellowship from University of Maryland *Fall 2015*
- Marshall Plan Scholarship from Austrian Marshall Plan Foundation *Summer 2014*

## SELECTED AWARDS CONTINUED

- School of Engineering Scholarship from Rutgers University 2014
- Undergraduate Research Fund for the Central Universities from SCUT 2012

## TEACHING EXPERIENCE

**Teaching Assistant**, Department of Chemical & Biomolecular Engineering, UMD

- Chemical & Biomolecular Engineering Thermodynamics I (CHBE301) *Fall 2016*
- Chemical & Biomolecular Separation Processes (CHBE426) *Spring 2017*

**Teaching Assistant**, Department of Chemistry & Biochemistry, UMD

- General Chemistry I Laboratory (CHEM132) *Spring 2016*

## SERVICES

- Co-organizer of mini-workshop on “MEDYAN: Stochastic Mechanochemical Modeling of Active Matters” at University of Maryland, MD. *Oct. 2019*

## COMPUTATIONAL SKILLS

- C++, MATLAB, Python, GROMACS, Excel, Aspen Plus