QIN NI

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RESEARCH INTERESTS

Biophysics of cytoskeleton, multiscale modeling, and non-equilibrium thermodynamics. Particularly interested in developing computational models or reconstituted *in vitro* systems to explore physical principles underlying active matter self-organization and dynamics.

EDUCATION

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

(*denotes equal contribution)

- Li, X*; **Ni, Q***; 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 progress)

- Vedula, P; Kurosaka, S; MacTaggart, B; **Ni, Q**; Papoian, GA; Jiang Y; Dong, D; Kashina, A. "Different translation dynamics of β- and γ-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*.

RESEARCH EXPERIENCE

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

- Co-developer of MEDYAN, an efficient and scalable computational model 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 energy dissipations and filament dynamics during actin – molecular motor (actomyosin) networks self-organization 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

Actomyosin-Microtubule Dynamics Regulates Centrosome Reorientation *Oct. 2019 - present*

- Study how steric interactions and crosslinking between microtubules and actomyosin regulate centrosome reorientation, which is an essential step of T-cell immune response.
- Develop a 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, and is 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, collaborating with experimentalists and theorists.
- Found that myosin - driven contractile self-organization follows anisotropic filament alignment produced by the relaxation of external force, creating the actin bundle structure.

Treadmilling Dynamics of Branched Actin Networks *Mar. 2016 - Sep. 2018*

- Explored the actin filament self-assembly dynamics, the treadmilling, with various regulatory proteins using MDEYAN simulations.
- Revealed how Arp2/3 and capping proteins regulate actin network treadmilling, and how treadmilling is different from the turnover rate quantified by fluorescence recovery after photobleaching.

PRESENTATIONS AND POSTERS

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*
- 11th 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 63rd 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

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