Guoming Gao

PhD Candidate · Biophysics Program

Room 2020, 930 N. University Ave., Ann Arbor, MI 48109

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Education

University of Michigan-Ann Arbor *Ann Arbor, MI*

Ph.D. Biophysics *Sep. 2018 - Mar. 2020, Jun. 2021 - Aug. 2024*

- Advisor: Dr. Nils G. Walter
- GPA: 4.00/4.00

Wuhan University *Wuhan, China*

B.S. Life Sciences *Sep. 2014 - Jun. 2018*

- Undergrad research advisor: Dr. Xinghua Zhang
- GPA: 3.85/4.00, Rank: 6/152

Research Experience

University of Michigan-Ann Arbor *Ann Arbor, MI*

Ph.D. Advisor: Dr. Nils G. Walter *Jan. 2020 - Present*

- Developed a system for **intra-condensate single-molecule tracking (SMT)** of RNA and protein molecules simultaneously
- Discovered *nanodomains* that confine diffusion within a condensate to extend molecular residence time and promote aging
- Systematically profiled RNA interactions with HOPS condensates via **smFISH** and **live-cell SMT**
- Revealed a new function of HOPS condensates as transient mimics of P bodies (PB) and stress granules (SG)
- Bench-marked condensate boundary detection methods using **microscopy simulation**
- Generated a guideline to select the best algorithm for condensates imaging under fluorescent microscopy

Rotation Advisor: Dr. Sarah Veatch *Sep. 2018 - Dec. 2018*

- Performed **Monte Carlo simulation** with a modified Ising model to probe the coupling between 2D and 3D phase separation

University of Texas - Southwestern Medical Center *Dallas, TX*

Advisor: Dr. Xuewu Zhang *Sep. 2017 - Apr. 2018*

- Determined a Plk4-bound structure of poly(A) polymerase FAM46 with X-ray crystallography

Wuhan University *Wuhan, China*

Advisor: Dr. Xinghua Zhang *Dec. 2015 - Jul. 2017*

- Established magnetic tweezers experiments to monitor R-loop formation in real time under the impact of chaperones

Skills

- **Biophysics**: single particle tracking (SPT); quantitative fluorescence microscopy; optical tweezers for condensate rheology; Monte Carlo (MC) simulation; Molecular Dynamics (MD) simulation; fluorescence lifetime imaging (FLIM); fluorescence correlation spectroscopy (FCS)
- **Cell Biology**: single-molecule fluorescence in situ hybridization (smFISH); immuno-staining; mammalian cell culture; transient transfection via liposome, electroporation, or bead-loading; stable cell line generation via drug selection
- **Biochemistry**: protein purification and labeling; RNA preparation by *in vitro* transcription and labeling; native and denaturing agarose and PAGE gel of DNA, RNA, and protein
- **Molecular Biology**: proficient in the complete workflow of molecular cloning; PCR mutagenesis
- **Bioinformatics**: proficient in ***Python***; Nanopore sequencing analysis; GO analysis; network analysis

Awards & Honors

2024 **Biophysical Society Student Research Achievement Award**, 68^{th} BPS Annual Meeting, Philadelphia, PA
2018 - 2023 **Rackham Conference Travel Grant (*4 times*)**, University of Michigan-Ann Arbor
2022 **Best Poster Award (*top 2 in 45*)**, 6^{th} Midwest Single-Molecule Workshop, Omaha, NE
2022 **RNA Society Research Presentation Fellowship**, 27^{th} RNA Society Meeting, Boulder, CO
2022 **Nomination for Rackham Predoctoral Fellowship**, University of Michigan-Ann Arbor
2021 **Rackham Graduate Student Research Grant**, University of Michigan-Ann Arbor
2021 **Nomination for OPGS Annual Graduate Student Teaching Award**, University of Michigan-Ann Arbor
2021 **Nomination for Rackham Outstanding GSI Awards**, University of Michigan-Ann Arbor
2020 **Biophysical Society Travel Award**, 64^{th} BPS Annual Meeting, San Diego, CA
2019 **Nomination for Rackham International Student Fellowship**, University of Michigan-Ann Arbor
2017 **China Scholarship Council (CSC) Scholarship for Exchange Study**, Wuhan University
2015-2017 **Outstanding Student Scholarship (*top 20 in 152, 3 times*)**, Wuhan University
2015 **International Genetically Engineered Machine (iGEM) Silver Award**, iGEM Foundation, Boston, MA

Oral Presentations

Mar. 2024 **Invited Talk:** *Single Molecule Tracking Reveals Nanodomains that Confine Diffusion in Protein-RNA Condensates*
Biophysics Week Virtual Seminar, Helmholtz-Institut für RNA-basierte Infektionsforschung (HIRI), Germany

Feb. 2024 **Platform Session Talk:** *Heterogeneity in Condensates Regulates Intra-Condensate Diffusion of RNA Single Molecules*
68^{th} BPS Annual Meeting, Philadelphia, PA

Dec. 2023 **Invited Talk:** *Biomolecular Condensates in Kidney Physiology and Disease*
George M. O'Brien Kidney Center Basic Science Seminar, University of Michigan, Ann Arbor, MI

Jun. 2022 **Plenary Talk:** *Differential Sorting Kinetics of Single Molecule RNAs in Hyperosmotic Phase Separation*
27^{th} RNA Society Meeting, Boulder, CO

Publications

Published

Gao, G. & Walter, N. G. Critical Assessment of Condensate Boundaries in Dual-Color Single Particle Tracking. ***J. Phys. Chem. B*** 127, 7694–7707 (**2023**). doi:10.1021/acs.jpcb.3c03776

Gao, G., Sumrall, E. R., Pitchiaya, S., Bitzer, M., Alberti, S., & Walter, N. G. Biomolecular condensates in kidney physiology and disease. ***Nat Rev Nephrol*** 19, 756–770 (**2023**) doi:10.1038/s41581-023-00767-0

Liu, S., Chen, H., Yin, Y., Lu, D., **Gao, G.**, Li, J., Bai, X., & Zhang, X. Inhibition of FAM46/TENT5 activity by BCCIPα adopting a unique fold. ***Science Advances*** 9, eadf5583 (**2023**). doi:10.1126/sciadv.adf5583

Jalihal, A. P., Schmidt, A., **Gao, G.**, Little, S. R., Pitchiaya, S., & Walter, N. G. Hyperosmotic phase separation: Condensates beyond inclusions, granules and organelles. ***J Biol Chem*** 296, 100044 (**2021**). doi:10.1074/jbc.REV120.010899

Schmidt, A., **Gao, G.**, Little, S. R., Jalihal, A. P. & Walter, N. G. Following the messenger: Recent innovations in live cell single molecule fluorescence imaging. ***Wiley Interdisciplinary Reviews: RNA*** 11, e1587 (**2020**). doi:10.1002/wrna.1587

Chen, H., Lu, D., Shang, G., **Gao, G.** & Zhang, X. Structural and Functional Analyses of the FAM46C/Plk4 Complex. ***Structure*** 28, 910-921.e4 (**2020**). doi:10.1016/j.str.2020.04.023

Preprint

Gao, G., Sumrall, E. R. & Walter, N. G. Single molecule tracking reveals nanodomains in biomolecular condensates. ***bioRxiv*** 2024.04..587651 (**2024**). doi:10.1101/2024.04.01.587651v1

In Prep

Gao, G., Sumrall, E. R., Li, X. & Walter, N. G. Single-molecule imaging reveals hyperosmotic Dcp1a condensates as counterparts of cytoplasmic RNP granules. (preparing manuscript for submission to ***Mol. Cell***)

Teaching Experience

2021 **BIOPHYS 117: Introduction to Scientific Programming**, TA supervised by Dr. Sarah Veatch
University of Michigan-Ann Arbor

2020 **BIOPHYS 535: Biophysics Modeling** , TA supervised by Dr. Aaron Frank
University of Michigan-Ann Arbor

2019 **CHEM/BIOLCHEM 451: Advanced Biochemistry** , TA supervised by Dr. Sarah Keane
University of Michigan-Ann Arbor

2016 **Biochemistry (*taught in English*)**, TA supervised by Dr. Lin Guo
Wuhan University, Wuhan, China

Community Services

2022 **Member of Biophysics Seminar Committee**, Biophysics Dept., University of Michigan-Ann Arbor
2022 **Poster Judge of the Karle Symposium**, Chemistry Dept., University of Michigan-Ann Arbor
2019 - 2022 **University of Michigan Student Representative**, Biophysical Society Annual Meetings
2019, 2022 **Recruiter for the Biophysics Graduate Program**, Biophysics Dept., University of Michigan-Ann Arbor
2014 **Volunteer Secondary School Teacher (Group Leader)**, NGO *Clover Youth*, Guangzhou, China

Mentoring

2023 - 2024 **Bisal Halder**, Graduate Student, Walter lab, University of Michigan-Ann Arbor
2022 - 2024 **Emily R. Sumrall**, Graduate Student, Walter lab, University of Michigan-Ann Arbor
2021 **Xin Li**, Rotation Student, Walter lab, University of Michigan-Ann Arbor
2020 - 2022 **Rebecca (Becky) Perelman**, Undergraduate Student, Walter lab, University of Michigan-Ann Arbor

Poster Presentations

Mar. 2024. **Gao, G.**, Sumrall, E. R. & Walter, N. G. *Single Molecule Tracking Reveals nano-Domains that Confine Diffusion in Protein-RNA Condensates.*
University of Michigan Center for RNA Biomedecine 8th Annual RNA Symposium, Ann Arbor, MI

Feb. 2024. **Gao, G.**, Sumrall, E. R. & Walter, N. G. *Heterogeneity in Condensates Regulates Intra-Condensate Diffusion of RNA Single Molecules.*
68th BPS Annual Meeting, Philadelphia, PA ***Best Poster Award***

Mar. 2023. **Gao, G.**, & Walter, N. G. *Critical Assessment of Condensate Boundaries in Dual-Color Single Molecule Tracking.*
University of Michigan Center for RNA Biomedecine 7th Annual RNA Symposium, Ann Arbor, MI

Aug. 2022 **Gao, G.** & Walter, N. G. *Differential Dynamic Recruitment of Single RNAs to Hyperosmotic Phase Separation (HOPS)*
6th Midwest Single Molecule Workshop, Omaha, NE ***Best Poster Award***

Jun. 2022 **Gao, G.** & Walter, N. G. *Differential Sorting Kinetics of Single Molecule RNAs in Hyperosmotic Phase Separation*
27th RNA Society Meeting, Boulder, CO

Feb. 2022. **Gao, G.**, Schimidt, A. & Walter, N. G. *Rapid Protein Phase Separation and RNA Diffusion Behavior Changes Under Hyperosmotic Cell Volume Compression.*
66th BPS Annual Meeting, San Francisco, CA

Feb. 2020. **Gao, G.**, Schimidt, A. & Walter, N. G. *RNA Trafficking between Membraneless Organelles at Single-Molecule Resolution in Live Cells.*
64th BPS Annual Meeting, San Diego, CA

Feb. 2019. **Gao, G.** & Veatch, S. *Using Ising-like Models to Probe Phase Separation at the Membrane-Cytoplasm Interface.*
63rd BPS Annual Meeting, Baltimore, MD