

Yi-Hsuan Lin

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EDUCATION

- Ph.D., Physics** 2015
The Ohio State University, Ohio, USA
Thesis: *The interplay between single-stranded binding proteins on RNA secondary structure*
Supervisor: Ralf Bundschuh
- B.Sc., Physics** 2009
University of Illinois at Urbana-Champaign, Illinois, USA
High Distinction in Physics
(National Taiwan University, Taiwan, 2005–2007, transferred)

RESEARCH SUMMARY

Theoretical and computational research at the intersection of physics, chemistry, and biology.
Focuses: polymer physics, biomolecular condensates, intrinsically disordered proteins, RNA-protein interaction.
11 invited talks, 15 papers, 755 citations, h-index = 10 (Apr 2021)

WORK EXPERIENCE

- Molecular Modeling Lead, HTuO Biosciences** Jan 2021 – present
- Developing the fundamental physics framework of molecular dynamics simulation force fields
 - Incorporating machine learning to parametrize force fields and optimize their simulation performance
 - Implementing mathematical physics to validate stability of various simulation methods
- Postdoctoral Fellow, University of Toronto / Hospital for Sick Children** Jul 2015 – Jul 2021
Project: *Theories for sequence-dependent phase behaviors of biomolecular condensates*
- Developing statistical physics and polymer theories for the "sequence specificity" in biological liquid-liquid phase separation, and collaborating with experimentalists and computational biologists
 - Develop Monte Carlo simulation programs from scratch for protein assemblies
Supervisors: Hue Sun Chan (Department of Biochemistry, University of Toronto)
Julie D. Forman-Kay (Molecular Medicine, The Hospital for Sick Children)
- Graduate Research Associate, The Ohio State University** Aug 2012 – May 2015
Project: *Biophysics of interactions between proteins and nucleic acids*
- Applied statistical mechanics to investigate the cooperativity between multiple RNA-binding proteins mediated by RNA secondary structure
 - Established theoretical framework for online RNA-protein binding predictor RBPBind
Supervisor: Ralf Bundschuh (Department of Physics)
- Graduate Research Associate, The Ohio State University** Aug 2011 – 2012 May
Project: *BEC-BCS crossover in cold-atomic systems*
- Applied the Nozières-Schmitt-Rink method to calculate the critical temperature in BEC-BCS crossover
Supervisor: Tin-Lun Ho (Department of Physics)

PUBLICATIONS

15. J. Wessén, T. Pal, S. Das, **Y.-H. Lin**, and H. S. Chan (2021) A simple explicit-solvent model of polyampholyte phase behaviors and its ramifications for dielectric effects in biomolecular condensates. *J. Phys. Chem. B* DOI: 10.1021/acs.jpcc.1c00954
14. S. Das, **Y.-H. Lin**, R. M. Vernon, J. D. Forman-Kay, and H. S. Chan (2020) Comparative roles of charge, π , and hydrophobic interactions in sequence-dependent phase separation of intrinsically disordered proteins. *Proc. Natl. Acad. Sci. U.S.A.* **117**, 28795–28805
13. A. N. Amin*, **Y.-H. Lin***, S. Das, and H. S. Chan (2020) Analytical theory for sequence-specific binary fuzzy complexes of charged intrinsically disordered proteins. *J. Phys. Chem. B* **124**, 6709–6720 (*equal contribution, selected supplementary cover)
12. **Y.-H. Lin**, J. P. Brady, H. S. Chan, and K. Ghosh (2020) A unified analytical theory of heteropolymers for sequence-specific phase behaviors of polyelectrolytes and polyampholytes. *J. Chem. Phys.* **152**, 045102
11. H. Cinar, R. Oliva, **Y.-H. Lin**, X. Chen, M. Zhang, H. S. Chan, and R. H. A. Winter (2020) Pressure sensitivity of SynGAP/PSD-95 condensates as a model for postsynaptic densities and its biophysical and neurological ramifications. *Chem. Eur. J.* **26**, 11024–11031 (cover feature)
10. S. Das, A. N. Amin, **Y.-H. Lin**, and H. S. Chan (2018) Coarse-grained residue-based models of disordered protein condensates: utility and limitations of simple charge pattern parameters. *Phys. Chem. Chem. Phys.* **20**, 28558–28574
9. **Y.-H. Lin**, J. D. Forman-Kay, and H. S. Chan (2018) Theories for sequence-dependent phase behaviors of biomolecular condensates. *Biochemistry* **57**, 2499–2508
8. S. Das, A. Eisen, **Y.-H. Lin**, and H. S. Chan (2018) A lattice model of charge-pattern-dependent polyampholyte phase separation. *J. Phys. Chem. B* **122**, 5418–5431
7. **Y.-H. Lin**, J. P. Brady, J. D. Forman-Kay, and H. S. Chan (2017) Charge pattern matching as a “fuzzy” mode of molecular recognition for the functional phase separations of intrinsically disordered proteins. *New J. Phys.* **19**, 115003
6. J. P. Brady, P. J. Farber, A. Sekhar, **Y.-H. Lin**, R. Huang, A. Bah, T. J. Nott, H. S. Chan, A. J. Baldwin, J. D. Forman-Kay, and L. E. Kay (2017) Structural and hydrodynamic properties of an intrinsically disordered region of a germ-cell specific protein upon phase separation. *Proc. Natl. Acad. Sci. U.S.A.* **114**, E8194–E8203
5. **Y.-H. Lin** and H. S. Chan (2017) Phase separation and single-chain compactness of charged disordered proteins are strongly correlated. *Biophys. J.* **112**, 2043–2046
4. **Y.-H. Lin**, J. Song, J. D. Forman-Kay, and H. S. Chan (2017) Random-phase-approximation theory for sequence-dependent, biologically functional liquid-liquid phase separation of intrinsically disordered proteins. *J. Mol. Liq.* **228**, 176–193
3. **Y.-H. Lin**, J. D. Forman-Kay, and H. S. Chan (2016) Sequence-specific polyampholyte phase separation in membraneless organelles. *Phys. Rev. Lett.* **117**, 178101
2. **Y.-H. Lin** and R. Bundschuh (2015) RNA structure generates natural cooperativity between single-stranded RNA binding proteins targeting 5' and 3'UTRs. *Nucleic Acids Res.* **43**, 1160–1169
1. **Y.-H. Lin** and R. Bundschuh (2013) Interplay between single-stranded binding proteins on RNA secondary structure. *Phys. Rev. E* **88**, 052707

Working Papers

- J. Gaither, **Y.-H. Lin**, and R. Bundschuh (2016) RBPBind: Quantitative prediction of Protein-RNA Interactions. Preprint: arXiv:1611.01245

HONORS AND AWARDS

- **Postdoctoral Award**, Intrinsically Disordered Protein Subgroup, Biophysical Society (USA) 2019
- **Connell Award for Best All Round Postdoctoral Fellow**, Department of Biochemistry, University of Toronto 2018
- **Dean's List**, College of Liberal Arts and Sciences, University of Illinois at Urbana-Champaign 2007
- **Presidential Award**, Department of Physics, National Taiwan University 2007
- **Gold Medal**, The 36th International Physics Olympiad 2005

Scholarships and Travel Awards

- **Travel Award**, Biophysical Society 63rd Annual Meeting (USA) 2019
- **Scholarship for Study Abroad**, Graduate Study, Taiwan Ministry of Education 2009–2013
- **Scholarship for Study Abroad**, Undergraduate Study, Taiwan Ministry of Education 2007–2009

PROFESSIONAL SERVICE

- Co-chair of "Using Polymer Sequence to Control Material Properties" session at the American Physical Society March Meeting 2019 (with Dr. Lisa Hall at The Ohio State University)

FREELANCE EXPERIENCE

ESG Data Scientist

Jun 2020 – Oct 2020

- Applied supervised machine learning algorithms and Bayesian statistics to build models for time series forecasting of environmental, social and corporate governance (ESG) financial data.

Science Advisor, StemCellerant

Nov 2019 – Dec 2019

- Providing consultation on biotech application and business development of new stem cell differentiation technology and systems biology.

MENTORING EXPERIENCE

Department of Biochemistry, University of Toronto

Designed research projects, provided instructions on math, physics, and computational methods, and manuscript writing

- Alan Amin, Research Undergraduate Student Sep 2017 – Jun 2019
Project: *Cluster-expansion theory for sequence-specific IDP-IDP interactions*
- Adam Eisen, Research Undergraduate Student Jun 2016 – Aug 2016
Project: *Monte Carlo simulation of lattice models for polyampholytes*

Molecular Medicine, The Hospital for Sick Children

Provided instructions on thesis writing and defense preparation

- Shuo-Chin Yen, Masters Student Jul 2018 – Sep 2018
Thesis: *Characterization of the dependence of Src:ND2 binding on phosphorylation and intramolecular Src interactions*

TEACHING EXPERIENCE

Lecturer, Center for Study Overseer Inc.	2020 – present
Teaching undergraduate level online courses in biology and physics, designing homework and exams and grading standards, and providing recitation sessions upon request	
Introduction to Physics (~10 students)	Summer 2020
Introduction to Biology (~10 students)	Summer 2020
Teaching Associate, Department of Physics, The Ohio State University	2009 – 2011
Taught regular homework review sessions and recitations before exams, provided office hours for students' needs of extra learning helps, and graded homework	
Physics 836, Electromagnetic Field Theory III (Graduate Level, ~70 students)	Spring 2011
Physics 835, Electromagnetic Field Theory II (Graduate Level, ~70 students)	Winter 2011
Physics 834, Electromagnetic Field Theory I (Graduate Level, ~70 students)	Autumn 2010
Physics 730, Methods of Theoretical Physics (~20 students)	Spring 2010
Physics 664, Theoretical Mechanics (~40 students)	Spring 2010
Physics 622, Statistical Physics II (~40 students)	Winter 2010
Physics 656, Fields and Waves II (~40 students)	Winter 2010
Physics 621, Statistical Physics I (~40 students)	Autumn 2009

PRESENTATIONS

Invited Seminars and Colloquia

11. Division of Physics in Medicine and Biology, Canadian Association of Physicists Congress, Online Jun 7, 2021
Introduction to machine learning and its application in biophysics and computational biology
10. Department of Physics, University of Manitoba, Winnipeg, MB, Canada Nov 25, 2020
Polymer field theory for sequence-specific intracellular phase separation of biological heteropolymers
9. Intrinsically Disordered Protein Subgroup, Biophysical Society 63rd Annual Meeting, Baltimore, MD, USA Mar 2, 2019
Polymer theory for the sequence-specific phase separation behaviors of charged intrinsically disordered proteins (Intrinsically Disordered Protein Subgroup Postdoctoral Award)
8. Institute of Chemistry, Chinese Academy of Sciences, Beijing, China PRC Oct 16, 2018
Theories and simulations for sequence-specific behaviors of intrinsically disordered proteins in liquid-liquid phase separation
7. Center for Quantitative Biology, Peking University, Beijing, China PRC Oct 15, 2018
Theories and simulations for sequence-specific behaviors of intrinsically disordered proteins in liquid-liquid phase separation
6. Institute of Biophysics, Central China Normal University, Wuhan, China PRC Oct 12, 2018
Theories and simulations for liquid-liquid phase separation in biology

5. Department of Biochemistry Retreat of University of Toronto, Geneva Park, Orillia, ON, Canada Oct 2, 2018
Sequence-specific theory for intrinsically disordered proteins in liquid-liquid phase separation (Connell Award for best all round postdoctoral fellow)
4. Protein Folding Consortium, University of California, Berkeley, CA, USA Jun 3, 2017
Sequence-specific behaviors of charged intrinsically disordered proteins in liquid-liquid phase separation
3. Molecular Structure and Function, The Hospital for Sick Children, Toronto, ON, Canada Mar 12, 2015
The interplay between single-stranded binding proteins on RNA secondary structures
2. Center for Theoretical Biophysics, Rice University, Houston, TX, USA Oct 27, 2014
The interplay between single-stranded binding proteins on RNA secondary structures
1. National Center for Theoretical Sciences, National Cheng Kung University, Tainan, Taiwan ROC Jun 9, 2014
The interplay between single-stranded binding proteins on RNA secondary structures

Contributed Talks

7. Canadian Association of Physicists Congress, Burnaby, BC, Canada Jun 4, 2019
Random phase approximation and renormalized Gaussian chain for charged hetero-biopolymers and their sequence-specific phase behavior
6. American Physical Society March Meeting, Boston, MA, USA Mar 8, 2019
Cluster-expansion theory for sequence-specific "fuzzy" interaction between pairs of intrinsically disordered proteins
5. Canadian Association of Physicists Congress, Halifax, NS, Canada Jun 14, 2018
Sequence-specific random-phase-approximation theory for polyampholytic intrinsically disordered proteins in liquid-liquid phase separation
4. Chemical Biophysics Symposium, Toronto, ON, Canada May 4, 2018
Sequence-specific polymer theory for charged intrinsically disordered proteins in liquid-liquid phase separation
3. American Physical Society March Meeting, New Orleans, LA, USA Mar 15, 2017
Random-phase-approximation theory for sequence-dependent behaviors of intrinsically disordered proteins in liquid-liquid phase separation
2. American Physical Society March Meeting, Denver, CO, USA Mar 5, 2014
Loop cost in RNA secondary structures and the long-range cooperativity between RNA-binding proteins
1. American Physical Society March Meeting, Baltimore, MD, USA Mar 22, 2013
The interplay between single-stranded binding proteins on RNA secondary structures

Poster Presentations

10. Biophysical Society of Canada 5th Annual Meeting, Mississauga, ON, Canada May 28–31, 2019
9. Biophysical Society 63rd Annual Meeting, Baltimore, MD, USA Mar 2–6, 2019
8. Gordon Research Conference – Polymer Physics, South Hadley, MA, USA Jul 21–27, 2018
7. Protein Folding Consortium, Ann Arbor, MI, USA Jun 8–10, 2018
6. Gordon Research Conference – Protein, Holderness, NH, USA Jun 18–23, 2017

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5. Biophysical Society of Canada 3rd Annual Meeting, Montréal, QC, Canada May 24–26, 2017
 4. Protein Folding Consortium, St. Louis, MO, USA Jun 9–12, 2016
 3. Rustbelt RNA Meeting, Pittsburgh, PA, USA Oct 17–18, 2014
 2. Soft Matter Science Summer School, Mittelwihr, France Jul 6–11, 2014
 1. Rustbelt RNA Meeting, Cleveland, OH, USA Oct 18–19, 2013