

# Yi-Hsuan Lin, PhD

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## EDUCATION

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### 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

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Theoretical and computational physics, chemistry, and biology. Focusing on polymer physics theories, protein molecular mechanisms, biopolymer phase separation, and RNA-protein interaction. **11** invited talks, **20** papers, **2381** citations, h-index = **17** (Nov 2025)

## ACADEMIC POSITIONS

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### Joint Postdoctoral Fellow

Jul 2015 – Jul 2021

Department of Biochemistry, University of Toronto

Molecular Medicine Program, Hospital for Sick Children

- Developing statistical physics theories for the “sequence specificity” in biological liquid-liquid phase separation
- Collaborating with experimentalists and computational biologists to test the above-mentioned physics theory
- Develop Monte Carlo simulation programs from scratch for modelling protein assemblies
- Published **16** peer-reviewed papers in theoretical/computational physics, chemistry, and biology
- Supervised and mentored over **3** junior scientists (students and trainees)

Project: *Theories for sequence-dependent phase behaviours of biomolecular condensates*

Supervisors: Hue Sun Chan (U Toronto) & Julie D. Forman-Kay (SickKids)

### Graduate Research Associate

Aug 2012 – May 2015

Department of Physics, The Ohio State University

- Developed statistical physics theory for RNA secondary structure and RNA-protein binding systems
- Developed Monte Carlo simulation programs for investigating RNA membrane translocation
- Developed solvable Markov system describing DNA-repair process
- Established theoretical framework for online RNA-protein binding predictor RBPBind
- Published **2** first-author papers in theoretical physics and bioinformatics

Project: *Biophysics of interactions between proteins and nucleic acids*

Supervisor: Ralf Bundschuh

### Graduate Research Associate

Aug 2011 – May 2012

Department of Physics, The Ohio State University

- Applied the Nozières-Schmitt-Rink method to calculate the phase transition temperature in BEC-BCS crossover

Project: *BEC-BCS crossover in cold-atomic systems*

Supervisor: Tin-Lun Ho

## PUBLICATIONS

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20. Fayet A, Ayoub A, Fejes A, Janežič M, **Lin Y-H**, Moitessier A, Moitessier N, Neal M, Pottel J, Rostaing O, Weiser B, Zoldan J, and Burai-Patrasu M (2025) The Sixth CACHE Challenge – A Comprehensive Drug Discovery Workflow to Discover Potential Inhibitors of the Triple Tudor Domain of SETDB1. *ChemRxiv*, DOI:10.26434/chemrxiv-2025-jrtx9
19. **Lin Y-H**, Kim TH, Das S, Pal T, Wessén J, Rangadurai AK, Kay LE, Forman-Kay JD, and Chan HS (2025) Electrostatics of salt-dependent reentrant phase behaviors highlights diverse roles of ATP in biomolecular condensates. *eLife* **13**:RP100284
18. **Lin Y-H**, Wessén J, Pal T, Das S, and Chan HS (2023) Numerical techniques for applications of analytical theories to sequence-dependent phase separations of intrinsically disordered proteins. In *Phase-Separated Biomolecular Condensates: Methods and Protocols* **2563** 51-94
17. Gaither J\*, **Lin Y-H\***, and Bundschuh R (2022) RBPBind: quantitative prediction of protein-RNA interactions. *J Mol Biol* **434** 167515 (\*equal contribution)
16. **Lin Y-H**, Wu H, Jia B, Zhang M, and Chan HS (2022) Assembly of model postsynaptic densities involves interactions auxiliary to stoichiometric binding. *Biophys J* **121** 151–171
15. Wessén J, Pal T, Das S, **Lin Y-H**, and Chan HS (2021) A simple explicit-solvent model of polyampholyte phase behaviors and its ramifications for dielectric effects in biomolecular condensates. *J Phys Chem B* **125** 4337–4358
14. Das S, **Lin Y-H**, Vernon RM, Forman-Kay JD, and Chan HS (2020) Comparative roles of charge,  $\pi$ , and hydrophobic interactions in sequence-dependent phase separation of intrinsically disordered proteins. *Proc Natl Acad Sci USA* **117** 28795–28805
13. Amin AN\*, **Lin Y-H\***, Das S, and Chan HS (2020) Analytical theory for sequence-specific binary fuzzy complexes of charged intrinsically disordered proteins. *J Phys Chem B* **124** 6709–6720 (\*equal contribution)
12. **Lin Y-H**, Brady JP, Chan HS, and Ghosh K (2020) A unified analytical theory of heteropolymers for sequence-specific phase behaviors of polyelectrolytes and polyampholytes. *J Chem Phys* **152** 045102
11. Cinar H, Oliva R, **Lin Y-H**, Chen X, Zhang M, Chan HS, and Winter RHA (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
10. Das S, Amin AN, **Lin Y-H**, and Chan HS (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. **Lin Y-H**, Forman-Kay JD, and Chan HS (2018) Theories for sequence-dependent phase behaviors of biomolecular condensates. *Biochemistry* **57** 2499–2508
8. Das S, Eisen A, **Lin Y-H**, and Chan HS (2018) A lattice model of charge-pattern-dependent polyampholyte phase separation. *J Phys Chem B* **122** 5418–5431
7. **Lin Y-H**, Brady JP, Forman-Kay JD, and Chan HS (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. Brady JP, Farber PJ, Sekhar A, **Lin Y-H**, Huang R, Bah A, Nott TJ, Chan HS, Baldwin AJ, Forman-Kay JD, and Kay LE (2017) Structural and hydrodynamic properties of an intrinsically disordered region of a germ-cell specific protein upon phase separation. *Proc Natl Acad Sci USA* **114** E8194–E8203
5. **Lin Y-H** and Chan HS (2017) Phase separation and single-chain compactness of charged disordered proteins are strongly correlated. *Biophys J* **112** 2043–2046
4. **Lin Y-H**, Song J, Forman-Kay JD, and Chan HS (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. **Lin Y-H**, Forman-Kay JD, and Chan HS (2016) Sequence-specific polyampholyte phase separation in membraneless organelles. *Phys Rev Lett* **117** 178101

2. **Lin Y-H** and Bundschuh R (2015) RNA structure generates natural cooperativity between single-stranded RNA binding proteins targeting 5' and 3'UTRs. *Nucleic Acids Res* **43** 1160–1169
1. **Lin Y-H** and Bundschuh R (2013) Interplay between single-stranded binding proteins on RNA secondary structure. *Phys Rev E* **88** 052707

## HONORS AND AWARDS

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

## Scholarships and Travel Awards

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| <b>Travel Award</b> , Biophysical Society 63 <sup>rd</sup> Annual Meeting (USA)         | 2019      |
| <b>Scholarship for Study Abroad</b> , Graduate Study, Taiwan Ministry of Education      | 2009–2013 |
| <b>Scholarship for Study Abroad</b> , Undergraduate Study, Taiwan Ministry of Education | 2007–2009 |

## PROFESSIONAL SERVICE

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- Poster judge for divisional student poster competition of the Division of Physics in Medicine and Biology at the Canadian Association of Physicists Congress 2021
- 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)

## INDUSTRIAL EXPERIENCE

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### HTuO Biosciences, Vancouver, BC, Canada

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|--|---------------------|
| <i>Research &amp; Development Lead</i> | Nov 2022 – present  |
| <i>Molecular Modelling Lead</i>        | Jan 2021 – Nov 2022 |

- Establish the physics principles of a proprietary molecular dynamics force field for pharmaceutical applications
- Develop a molecular mechanism platform based on the proprietary force field
- Design and implement free energy simulation methods for protein-ligand binding systems
- Incorporate machine learning to parametrize force fields and optimize their simulation performance
- Implement mathematical physics to validate stability of various simulation methods

### Sustainability.Exchange, Toronto, ON, Canada

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| <i>Data Scientist</i> | 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.

### StemCellerant, Boston, MA, USA

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| <i>Science Advisor (Remote)</i> | Nov 2019 – Dec 2019 |
|---------------------------------|---------------------|

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

## MENTORING EXPERIENCE

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### 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

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### Lecturer, Center for Study Overseer Inc.

2020

Taught undergraduate level online courses in biology and physics, designing homework and exams and grading standards, and providing recitation sessions upon request

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| 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

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| 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

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### Invited Seminars and Colloquia

11. *Introduction to machine learning and its application in biophysics and computational biology*, Division of Physics in Medicine and Biology (DPMB) 101 Lecture, Canadian Association of Physicists Congress, Online, **Jun 7, 2021**
10. *Polymer field theory for sequence-specific intracellular phase separation of biological heteropolymers*, Department of Physics, University of Manitoba, Winnipeg, MB, Canada (Held Online), **Nov 25, 2020**
9. *Polymer theory for the sequence-specific phase separation behaviors of charged intrinsically disordered proteins*, Intrinsically Disordered Protein Subgroup Postdoctoral Award Talk, Biophysical Society 63<sup>rd</sup> Annual Meeting, Baltimore, MD, USA, **Mar 2, 2019**
8. *Theories and simulations for sequence-specific behaviors of intrinsically disordered proteins in liquid-liquid phase separation*, Institute of Chemistry, Chinese Academy of Sciences, Beijing, China PRC, **Oct 16, 2018**
7. *Theories and simulations for sequence-specific behaviors of intrinsically disordered proteins in liquid-liquid phase separation*, Center for Quantitative Biology, Peking University, Beijing, China PRC, **Oct 15, 2018**

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

### Contributed Talks

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

### Poster Presentations

12. American Chemical Society Fall Meeting, Denver, CO, USA, Aug 17–22, 2024  
*AtomForge: Advances in the development of polarizable force field*
11. American Chemical Society Fall Meeting, San Francisco, CA, USA Aug 13–17, 2023  
*AtomForge: A novel polarizable and reactive force field for commercial scale applications*
10. Biophysical Society of Canada 5<sup>th</sup> Annual Meeting, Mississauga, ON, Canada May 28–31, 2019  
*Sequence-specific polymer theory for intrinsically disordered proteins in liquid-liquid phase separation*
9. Biophysical Society 63<sup>rd</sup> Annual Meeting, Baltimore, MD, USA Mar 2–6, 2019  
*Sequence-specific random-phase-approximation theory for polyampholytic intrinsically disordered proteins in liquid-liquid phase separation*
8. Gordon Research Conference – Polymer Physics, South Hadley, MA, USA Jul 21–27, 2018  
*Sequence-specific random-phase-approximation theory for polyampholytic intrinsically disordered proteins in liquid-liquid phase separation*
7. Protein Folding Consortium, Ann Arbor, MI, USA Jun 8–10, 2018  
*Sequence-specific polymer theory for intrinsically disordered proteins in liquid-liquid phase separation*

6. Gordon Research Conference – Protein, Holderness, NH, USA Jun 18–23, 2017  
*Sequence-specific behaviors of charged intrinsically disordered proteins in liquid-liquid phase separation*
5. Biophysical Society of Canada 3<sup>rd</sup> Annual Meeting, Montréal, QC, Canada May 24–26, 2017  
*Sequence-specific behaviors of charged intrinsically disordered proteins in liquid-liquid phase separation*
4. Protein Folding Consortium, St. Louis, MO, USA Jun 9–12, 2016  
*Sequence-specific polyampholyte phase separation in membraneless organelles*
3. Rustbelt RNA Meeting, Pittsburgh, PA, USA Oct 17–18, 2014  
*Structure-mediated cooperativity between single-stranded RNA binding partners on 5' and 3'UTRs*
2. Soft Matter Science Summer School, Mittelwihr, France Jul 6–11, 2014  
*Interplay between single-stranded binding proteins on RNA secondary structure*
1. Rustbelt RNA Meeting, Cleveland, OH, USA Oct 18–19, 2013  
*Cooperativity between single-stranded binding proteins on RNA secondary structure*