
ELLEN D. ZHONG

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EDUCATION

- 2022 **Massachusetts Institute of Technology, Cambridge, MA**
Ph.D. Computational and Systems Biology
- 2014 **University of Virginia, Charlottesville, VA**
B.S. Chemical Engineering with highest distinction

PROFESSIONAL APPOINTMENTS

- 2022 - Present **Princeton University**
Assistant Professor, Department of Computer Science
Associated Faculty, Quantitative and Computational Biology
Associated Faculty, Omenn-Darling Bioengineering Institute
Associated Faculty, Center for Statistics and Machine Learning
Associated Faculty, Princeton Language Initiative
- 2022 - Present **Flatiron Institute**
Visiting Researcher
- 2017 - 2022 **Massachusetts Institute of Technology**
Ph.D. Computational and Systems Biology
Computer Science and Artificial Intelligence Lab
Advisors: Bonnie Berger (Mathematics, EECS), Joseph H. Davis (Biology)
Thesis: "Machine learning for reconstructing dynamic protein structure from cryo-EM images"
- Summer 2021 **Google DeepMind**
Research Scientist Intern
Hosted by John Jumper and the AlphaFold team
- 2014 - 2017 **D. E. Shaw Research**
Scientific Associate and Scientific Programmer
Algorithms and infrastructure for free energy calculations for drug discovery
- Summer 2013 **D. E. Shaw Research**
Scientific Programmer Intern
- Summer 2011 **NASA/Johns Hopkins Applied Physics Lab**
MESSENGER Imaging Team
- 2010 - 2014 **University of Virginia**
B.S. Chemical Engineering with highest distinction
Advisor: Michael R. Shirts (Chemical Engineering)
Thesis: "Thermodynamics of protein folding with Hamiltonian Monte Carlo simulations"

PUBLICATIONS

1. Deep reconstructing generative networks for visualizing dynamic biomolecules inside cells. Rangan R, Khavnekar S, Lerer A, Johnston J, Kelley R, Obr M, Kotecha A, **Zhong ED**. *bioRxiv*, 2023.
2. Time-resolved cryo-EM (TR-EM) analysis of substrate polyubiquitination by the RING E3 anaphase-promoting complex/cyclosome (APC/C). Bodrug T, ... **Zhong ED**, Haselbach H, Brown NG. *Nature Structural and Molecular Biology*, 2023.
3. Conformational heterogeneity and probability distributions from single particle cryo-electron microscopy. Tang WS, **Zhong ED**, Hanson SM, Theide EH, Cossio P. *Current Opinion in Structural Biology*, 2023
4. Amortized inference for heterogeneous reconstruction in cryo-EM. Levy A, Wetzstein G, Martel J, Poitevin F, **Zhong ED**. *Neural Information Processing Systems (NeurIPS)*, 2022.
5. Latent Space Diffusion Models of Cryo-EM Structures. Kreis K, Dockhorn T, Li Z, **Zhong ED**. *NeurIPS Machine Learning in Structural Biology (MLSB) Workshop*, 2022. Oral presentation.
6. Deep Generative Modeling for Volume Reconstruction in Cryo-Electron Microscopy. Donnat C, Levy A, Poitevin F, **Zhong ED**, Miolane N. *Journal of Structural Biology*, 2022.
7. Uncovering structural ensembles from single particle cryo-EM data using cryoDRGN. Kinman LF+, Powell BM+, **Zhong ED***, Berger B*, Davis JH*. (*Corresponding, +Equal contribution). *Nature Protocols*, 2022.
8. Conformational landscape of the yeast SAGA complex as revealed by cryo-EM. Vasyliuk D, Felt J, **Zhong ED**, Berger B, Davis JH, Yip CK. *Scientific Reports*, 2022.
9. Cryo-EM structure of the plant 26S proteasome. Kandolf S, Grishkovskaya I, Belai K, Bolhuis DL, Amann S, Foster B, Imre R, Mechtler K, Schleiffer A, Tagare HD, **Zhong ED**, Meinhart A, Brown NG, Haselbach D. *Plant Communications*, 2022.
10. CryoDRGN2: Ab initio neural reconstruction of 3D protein structures from real cryo-EM images. **Zhong ED**, Lerer A, Davis JH, Berger B. *International Conference on Computer Vision (ICCV)*, 2021.
11. CryoDRGN: Reconstruction of heterogeneous cryo-EM structures using neural networks. **Zhong ED**, Bepler T, Berger B, Davis JH. *Nature Methods*, 2021.
12. Learning the language of viral evolution and escape. Hie B, **Zhong ED**, Berger B, Bryson B. *Science*, 2021
13. Structures of radial spokes and associated complexes important for ciliary motility. Gui M, Ma M, Sze-Tu E, Wang X, Koh F, **Zhong ED**, Berger B, Davis JH, Dutcher S, Zhang R, Brown A. *Nature Structural and Molecular Biology*, 2021.
14. Exploring generative atomic models in cryo-EM reconstruction. **Zhong ED**, Lerer A, Davis JH, Berger B. *NeurIPS Machine Learning in Structural Biology (MLSB) Workshop*, 2020.
15. Learning mutational semantics. Hie B, **Zhong ED**, Bryson B, Berger B. *Neural Information Processing Systems (NeurIPS)* 2020.
16. RNA timestamps identify the age of single molecules in RNA sequencing. Rodriques SG, Chen LM, Liu S, **Zhong ED**, Scherrer JR, Boyden ES, Chen F. *Nature Biotechnology*, 2020.
17. Reconstructing continuous distributions of 3D protein structure from cryo-EM images. **Zhong ED**, Bepler T, Davis JH, Berger B. *International Conference on Learning Representations (ICLR)* 2020. Spotlight presentation. Machine Learning in Computational Biology (MLCB), 2019. Oral presentation. NeurIPS Learning Meaningful Representations of Life (LMRL) workshop, 2019.
18. Explicitly disentangling image content from translation and rotation with spatial-VAE. Bepler T, **Zhong ED**, Kelley K, Brignole E, Berger B. *Neural Information Processing Systems (NeurIPS)* 2019.
19. Lessons learned from comparing molecular dynamics engines on the SAMPL5 dataset. Shirts MR, Klein C, Swails JM, Yin J, Gilson MK, Mobley DL, Case DA, **Zhong ED**. *J. Comput. Aided. Mol. Des.* 2016.
20. Thermodynamics of Coupled Protein Adsorption and Stability using Hybrid Monte Carlo simulations. **Zhong ED**, Shirts MR. *Langmuir* 2014.

21. Areas of permanent shadow in Mercurys south polar region ascertained by MESSENGER orbital imaging. Chabot NL, Ernst CM, Denevi BW, ... **Zhong ED**. *Geophys. Res. Lett.* 2012.

SEMINARS

Upcoming:

1. Jul 2024: Protein Society Annual Meeting, Vancouver, Canada
2. June 2024: Keynote, 3DEM Gordon Research Seminar, Castelldefels, Spain
3. Mar 2024: EMBO|EMBL Symposium on AI and Biology, Heidelberg, Germany
4. Jan 2024: EMBL Cryo-EM in Industry and Academia, Heidelberg, Germany
5. Dec 2023: NeurIPS Deep Learning and Inverse Problems Workshop, New Orleans, LA
6. Dec 2023: NeurIPS Generative AI and Biology Workshop, New Orleans, LA
7. Nov 2023: Toronto Vision Seminar, Toronto, Canada

2023:

8. Oct 2023: NYU Langone, New York, NY
9. Oct 2023: Keynote, CryoNet, Stockholm, Sweden
10. Sept 2023: MIT Bioinformatics Seminar, Cambridge, MA
11. Aug 2023: University of Copenhagen NNF Center for Protein Research, Copenhagen, Denmark
12. July 2023: American Crystallography Association Annual Meeting, Baltimore, MD
13. July 2023: Symposium on Geometry Processing, Genoa, Italy
14. June 2023: EMBL Heidelberg, Heidelberg, Germany
15. June 2023: Google Research, Virtual
16. June 2023: Flatiron Institute workshop on Cryo-EM methods, New York, NY
17. May 2023: University of Pennsylvania Structural Biology Symposium, Philadelphia, PA
18. May 2023: Princeton Catalysis Initiative, Princeton, NJ
19. May 2023: University of Michigan Cryo-EM Data Processing Workshop, Ann Arbor, MI
20. May 2023: ICLR Neural Fields Across Fields Workshop, Kigali, Rwanda
21. Apr 2023: UC Davis Department of Molecular and Cellular Biology, Davis, CA
22. Apr 2023: Stanford SCIEN Seminar Series, Palo Alto, CA
23. Apr 2023: Caltech AI4Science Seminar Series, Pasadena, CA
24. Mar 2023: University of Washington Institute of Protein Design, Seattle, WA
25. Mar 2023: North Atlantic Microscopy Society Annual Meeting, Princeton, NJ
26. Mar 2023: Columbia Physiology and Cellular Biophysics, New York, NY
27. Feb 2023: Biophysical Society Annual Meeting, San Diego, CA
28. Jan 2023: Brigham Young University Department of Chemistry and Biochemistry, Provo, UT

2022:

29. Dec 2022: MIT 6.S980 Machine Learning for Inverse Graphics guest lecture, Cambridge, MA
30. Nov 2022: Institute of Pure and Applied Mathematics (IPAM) workshop, Los Angeles, CA
31. Nov 2022: Cold Springs Harbor Laboratory, Course on Cryo-EM, Long Island, NY
32. Nov 2022: Flatiron Institute Workshop on Sampling, Diffusion, and Transport, New York, NY
33. Nov 2022: Chan Zuckerberg Imaging Institute, Frontiers in Cryo-Electron Tomography, San Francisco, CA
34. Oct 2022: Yale Department of Statistics and Data Science, New Haven, CT
35. Oct 2022: Keynote, MIT Molecule Machine Learning Conference, Cambridge, MA
36. Oct 2022: Purdue Department of Computer Science, Virtual
37. Oct 2022: Rutgers Institute for Quantitative Biomedicine and RCSB Protein Data Bank, Virtual
38. Sept 2022: Nature Conferences, Electron Microscopy for Physical and Life Sciences, Princeton, NJ
39. Sept 2022: Van Andel Institute, Virtual
40. Aug 2022: Microscopy & Microanalysis, Portland, OR

41. Jun 2022: CVPR, Neural Fields in Computer Vision Tutorial, New Orleans, LA
42. Apr 2022: ICLR Deep Generative Models for Highly Structured Data Workshop, Virtual
43. Apr 2022: VIB-VUB Center of Structural Biology, Virtual
44. Apr 2022: CCP-EM/CCPBioSim Cryo-EM Dynamics Discussion Meeting, Virtual
45. Mar 2022: Vienna Biocenter IMBA/IMP Young Investigator Symposium, Virtual
46. Mar 2022: SIAM Conference on Imaging Science, Cryo-EM Mini-symposium, Virtual
47. Mar 2022: SLAC/Stanford University, Palo Alto, CA
48. Mar 2022: John Hopkins University Cryo-EM Seminar Series, Virtual
49. Mar 2022: Brookhaven National Lab Applied Mathematics Seminar Series, Virtual
50. Mar 2022: International Conference on Image Analysis in Three-dimensional Cryo-EM, Lake Tahoe, CA
51. Mar 2022: OpenEye CUP Conference, Santa Fe, NM
52. Feb 2022: Princeton Department of Computer Science, Princeton, NJ
53. Feb 2022: Columbia Department of Computer Science, Virtual

2021:

54. Nov 2021: MRC Laboratory of Molecular Biology, Cambridge, UK
55. Nov 2021: The Francis Crick Institute, London, UK
56. Nov 2021: Microsoft Research New England, Virtual
57. Oct 2021: Session chair introductory remarks, 3DEM Gordon Research Conference, Waterville Valley, NH
Cryo-EM and AlphaFold in translational research
58. Sept 2021: Scientific Computing in Structural Biology Workshop, Stanford SLAC Users Meeting, Virtual
59. Aug 2021: RosettaCon, Virtual
60. Aug 2021: American Crystallographic Association Annual Meeting, Virtual
61. Apr 2021: CCP-EM Spring Symposium, Virtual
62. Apr 2021: GlaxoSmithKline (GSK), Virtual
63. Feb 2021: Princeton University Applied Mathematics IDeAS Seminar, Virtual
64. Feb 2021: UIUC Coordinated Science Laboratory Student Conference (CSLSC), Virtual

2020 and earlier:

65. Nov 2020: Vienna BioCenter, Research Institute of Molecular Pathology (IMP) Seminar Series, Virtual
66. Sept 2020: SciLifeLab Advanced Cryo-EM Seminar Series, Virtual
67. Aug 2020: Microscopy & Microanalysis, Virtual
68. May 2020: SBGrid Annual Symposium, Virtual
69. Feb 2020: Relay Therapeutics, Cambridge, MA
70. Dec 2019: Machine learning in Computational Biology (MLCB) meeting, Vancouver, BC
71. Dec 2019: Poster: NeurIPS Learning Meaningful Representations of Life (LMRL) workshop, Vancouver, BC
72. Dec 2019: Harvard Cryo-EM Club, Cambridge, MA
73. Nov 2019: Poster: Janelia Women in Computational Biology Meeting, Ashburn, VA
74. Oct 2019: New England CryoEM symposium, Worcester, MA
75. Aug 2019: Poster: Flatiron Institute Computational Cryo-EM Workshop, New York, NY
76. Nov 2015: Out in STEM National Conference, Pittsburgh, PA
From silicon to medicine: Challenges in molecular dynamics for early-stage drug discovery
77. Oct 2015: Grace Hopper Annual Conference, Houston, TX
Optimizing molecular visualization for drug discovery.
78. Nov 2013: AIChE Annual Meeting, San Francisco, CA
Efficient simulation of protein stability on surfaces using a Hamiltonian Monte Carlo approach.

TEACHING

Fall 2023 COS597N: Machine Learning for Structural Biology

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MENTORING

Postdoctoral Fellows

2023-Present Ramya Rangan

2023-Present Ryan Feathers (co-advised with Fred Hughson)

Graduate Students

2023-Present Minkyu Jeon, Ph.D. Computer Science

2023-Present Alkin Kaz, M.Eng. Electrical and Computer Engineering

2022-Present Rishwanth Raghu, M.S. Computer Science

2022-2023 Mark Castellano, M.Eng. Electrical and Computer Engineering

Undergraduate Students

2023-Present David Shustin, B.S.E. Computer Science

2023-Present Vicky Feng, B.A. Computer Science

Other Group Members

2022-Present Michal Grazdowski, Senior Research Software Engineer

2022-2023 Vineet Bansal, Visiting Research Software Engineer

ACADEMIC SERVICE

Area chair: Neural Informational Processing Systems (NeurIPS)

Reviewer: Nature Methods, Neural Information Processing Systems (NeurIPS), International Conference on Learning Representations (ICLR), International Conference on Machine Learning (ICML), Machine Learning in Computational Biology Workshop (MLCB), Machine Learning in Structural Biology Workshop (MLSB), IEEE Transactions on Computational Biology and Bioinformatics, IEEE Transactions on Computational Imaging, Biophysical Journal, Journal of Physical Chemistry Letters, Scientific Reports

Meetings: 2024, Nature Conferences, Frontiers in Electron Microscopy for Physical and Life Sciences
2020-2023, Machine Learning in Structural Biology Workshop at NeurIPS

OTHER PROFESSIONAL ACTIVITIES

2023 - Present Chan Zuckerberg Imaging Institute, Scientific Advisory Board

2023 - Present Deep Apple Therapeutics, Scientific Advisory Board

2022 - Present Foresite Labs, Consultant

2020 - 2022 Sanofi-Pasteur, Consultant

2018 - 2019 Rough Draft Ventures / General Catalyst, Venture Fellow

AWARDS

2021 American Crystallographic Association Etter Student Lecturer Award

2019 Best paper award at Machine Learning in Computational Biology Workshop

2019 Teaching Award, MIT Biology

2017 NSF Graduate Research Fellowship

2014 NSF Graduate Research Fellowship (Declined)

2014 Louis T. Rader Chemical Engineering Prize

2014 American Institute of Chemists Award

2013 Barry M. Goldwater Scholarship

2012, 2013 Astronaut Scholarship

PRESS

- 11/2023 BitesizeBio webinar, [“Machine Learning Approach to Cellular Cryo-Tomography”](#)
- 10/2023 The Atlantic Festival, Panelist [“What Would It Take to Transform Drug Discovery With AI?”](#)
- 06/2023 Princeton University News, [“Princeton’s 5th PCI Symposium”](#)
- 06/2023 Webinar interview with the Hive Think Tank, [“Beyond Language: Reasoning over Non-Language Data with Generative AI”](#)
- 09/2022 [Video podcast interview](#) on the Plunge, Thermo Fisher
- 09/2021 VPRO TV Documentary, [“Tomorrow’s medicine”](#)
- 06/2021 MIT News, [“The power of two”](#)