

Asher Preska Steinberg, PhD

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EDUCATION & TRAINING

New York University

LSRF POSTDOCTORAL FELLOW IN BIOLOGY

Advisor: Edo Kussell

New York, NY | Jun 2019

California Institute of Technology

PHD IN CHEMISTRY

Thesis advisor: Rustem F. Ismagilov

Thesis committee: Zhen-Gang Wang (chair), David A. Tirrell, Julie A. Kornfield

Thesis: *How polymers shape the physicochemical environment of the gut*

Thesis awarded McCoy Award for best thesis in the Division of Chemistry & Chemical Engineering at Caltech

Pasadena, CA | Apr 2019

Brandeis University

BA IN CHEMISTRY WITH HIGHEST HONORS AND BA IN PHYSICS

summa cum laude

Thesis Advisor: Milos Dolnik

Thesis: *Growth dynamics of Turing patterns in the photosensitive CDIMA reaction*

Waltham, MA | May 2013

HONORS, AWARDS, & FELLOWSHIPS

2020-present Life Sciences Research Foundation Postdoctoral Fellowship (Simons Foundation Awardee)

2019 Herbert Newby McCoy Award at Caltech (In recognition of the most outstanding achievements in research by a graduate student in the CCE Division)

2018-2019 Caldwell CEMI Graduate Fellowship at Caltech

2013-2018 National Science Foundation Graduate Research Fellowship

2013 Molly W. and Charles K. Schiff Memorial Award in Science at Brandeis University

2010 Winner of CRC Press Chemistry Achievement Award at Brandeis University

PUBLICATIONS

10. **A. Preska Steinberg**, O.K. Silander, E. Kussell. "Correlated substitutions reveal SARS-like coronaviruses recombine frequently with a diverse set of structured gene pools". *Proc Natl Acad Sci USA* **2023**, 120 (5), e2206945119.
[Highlighted in PNAS.](#)
9. **A. Preska Steinberg**, M. Lin, E. Kussell. "Core genes can have higher recombination rates than accessory genes within global microbial populations". *eLife* **2022**, 11:e78533.
8. M. K. Porter, **A. Preska Steinberg**, R. F. Ismagilov. "Interplay of motility and polymer-driven depletion forces in the initial stages of bacterial aggregation". *Soft Matter* **2019**, 15, 7071-7079.
7. **A. Preska Steinberg**, Z. G. Wang, R. F. Ismagilov. "Food polyelectrolytes compress the colonic mucus hydrogel by a Donnan mechanism". *Biomacromolecules* **2019**, 20 (7), 2675-2683.
6. **A. Preska Steinberg**, S. S. Datta, T. Naragon, J. C. Rolando, S. R. Bogatyrev, R. F. Ismagilov. "High-molecular-weight polymers from dietary fiber drive aggregation of particulates in the murine small intestine". *eLife* **2019**, 8:e40387.
5. S. S. Datta, **A. Preska Steinberg**, R. F. Ismagilov. "Polymers in the gut compress the colonic mucus hydrogel". *Proc Natl Acad Sci USA* **2016**, 113 (26), 7041-7046.
4. L. Haim, A. Hagberg, R. Nagao, **A. Preska Steinberg**, M. Dolnik, I. R. Epstein, E. Meron. "Fronts and patterns in a spatially forced CDIMA reaction". *Phys Chem Chem Phys* **2014**, 16 (47), 26137-26143.
3. **A. Preska Steinberg**, I. R. Epstein, M. Dolnik. "Target Turing Patterns and Growth Dynamics in the Chlorine Dioxide-Iodine-Malonic Acid reaction". *J Phys Chem A* **2014**, 118 (13), 2393-2400.
2. E. S. Thrall, **A. Preska Steinberg**, X. Wu, L. E. Brus. "The Role of Photon Energy and Semiconductor Substrate in the Plasmon-Mediated Photooxidation of Citrate by Silver Nanoparticles". *J Phys Chem C* **2013**, 117 (49), 26238-26247.
1. J. Palacci, S. Sacanna, **A. Preska Steinberg**, D. J. Pine, P. M. Chaikin. "Living Crystals of Light-Activated Colloidal Surfers". *Science* **2013**, 339 (6122), 936-940.

PATENT APPLICATIONS

1. R. F. Ismagilov, S. S. Datta, **A. Preska Steinberg**, S. R. Bogatyrev. "Polymeric compositions and related systems and methods for regulating biological hydrogels". US 15/399,711, **2017**.

MANUSCRIPTS IN PREPARATION

1. **A. Preska Steinberg**, E. Kussell. "Bacterial lineages are shaped by variance in coalescence times and recombination rates".

RESEARCH EXPERIENCE

New York University | LSRF POSTDOCTORAL FELLOW

New York, NY | Jun 2019 – present

Advisor: Dr. Edo Kussell

- Investigating the role of homologous recombination in microbial genome evolution using a combination of computational biology, bioinformatics, and population genetics.

California Institute of Technology | NSF GRADUATE FELLOW

Pasadena, CA | Nov 2013-Apr 2019

Advisor: Dr. Rustem F. Ismagilov

- Studied how dietary and host-secreted polymers shape the physicochemical environment of the gut using experimental and theoretical approaches from polymer physics.

Brandeis University | RESEARCH ASSISTANT

Waltham, MA | Sept 2011-May 2013

Advisor: Dr. Milos Dolnik (Irv Epstein Group)

- Received highest honors for thesis on growth dynamics of Turing patterns in chemical systems.

Columbia University | EFRC RPU FELLOW

New York, NY | May-Aug 2012

Advisor: Dr. Louis Brus

- Studied the photo-oxidation of citrate by plasmonic silver nanoparticles in a photo-electrochemical cell.

New York University | NSF MRSEC REU FELLOW

New York, NY | Jun-Aug 2011

Advisor: Dr. Paul Chaikin

- Studied non-equilibrium properties of active suspensions of artificial light-activated microswimmers as a framework for understanding the physics of active matter.

SELECTED TALKS & PRESENTATIONS

- Nov 2022: "Mutational correlation functions reveal patterns of homologous recombination across the bacterial pangenome". AIChE Annual Meeting, Phoenix, AZ. (Talk & Poster)
- Aug 2022: "Core genes can have higher recombination rates than accessory genes within global microbial populations". Molecular Genetics of Bacteria and Phages Meeting, University of Wisconsin, Madison, WI. (Poster)
- Jul 2022: "Core genes can have higher recombination rates than accessory genes within global microbial populations". GRC on Microbial Stress Response, Mt. Holyoke College, South Hadley, MA. (Poster)
- Mar 2022: "Core genes can have higher recombination rates than accessory genes within global microbial populations". APS March Meeting. (Virtual Talk)
- Jun 2019: "How polymers shape the physicochemical environment of the gut". McCoy Award Symposium, Caltech, Chemistry and Chemical Engineering, Pasadena, CA. (Talk)
- Jun 2019: "The physics of the gut: How polymers shape a microbial home". GRC on Molecular Mechanisms in Evolution, Stonehill College, Easton, MA. (Poster)
- Sept 2018: "High-molecular-weight polymers from dietary fiber drive aggregation of particulates in the murine small intestine". Caltech CCE Seminar Day, Caltech, Chemistry and Chemical Engineering, Pasadena, CA. (Talk)
- Sept 2018: "High-molecular-weight polymers from dietary fiber drive aggregation of particulates in the murine small intestine". Frontiers in Soft Matter and Macromolecular Networks, USD, San Diego, CA. (Talk)
- Jul 2018: "Polymers compress the colonic mucus hydrogel". Mechanobiology Symposium: The Mechanome in Action, UC Irvine, Irvine, CA. (Talk & Poster)
- Sept 2017: "Polymers compress colonic mucus hydrogel in vitro and in vivo". Frontiers in Soft Matter and Macromolecular Networks, USD, San Diego, CA. (Talk)
- Mar 2017: "Physics of the gut: How polymers dynamically structure the gut environment". APS March Meeting, New Orleans, LA. (Talk)

SKILLS

Analytical/computational skills

Population Genetics: Coalescent models with recombination in [Pubs #9-10](#).

Bioinformatics: Developed bacterial and viral recombination analysis pipelines in [Pubs #9-10](#), developed sequence clustering pipeline in [Pub #9](#), and performed sequence evolution simulations in [Pub #10](#).

Polymer physics: Numerical calculations and theory in [Pubs #5-8](#).

Linux-based HPC environments: Recombination analysis and clustering of >500,000 microbial genomes in [Pubs #9-10](#).

Image analysis: Quantification of colloidal suspension structure in [Pub #6](#) and colonic mucus structure in [Pubs #5 & 7](#).

Programming: Python, Go, Java (basic knowledge), Shell scripting

Applications: ImageJ, Mathematica

Laboratory skills

Ex vivo and in vivo mouse experiments: Experiments to understand gut polymer physics in [Pubs #5-7](#).

Confocal microscopy: Ex vivo imaging of polymer-mucus interactions and particle aggregation in intestinal fluid in [Pubs #5-7](#).

Biopolymer characterization: Developed new methods to quantify the polymeric composition of intestinal fluid using gel permeation chromatography, western blot of intestinal proteins, dynamic light scattering and zeta potential measurements of colloids ([Pubs #5-7](#)).

TEACHING & MENTORING

California Institute of Technology | ISMAGILOV LAB

Pasadena, CA | Oct 2017-Dec 2018

- Served as research mentor for PhD Rotation Students:
 - Fall term 2018: Robert Grayson (Chemical Engineering)
 - Winter term 2018: Michael Porter (Chemical Engineering)
 - Fall term 2017: Thomas Naragon (Chemistry)

Brandeis University | SUPPLEMENTAL INSTRUCTION LEADER

Waltham, MA | Sept 2010-May 2013

- Led review sessions, proctored quizzes, attended classes, and answered questions students had about course material for the General Chemistry course.

OUTREACH & ADDITIONAL ACTIVITIES

- Volunteer**, Physics demos for Caltech educational outreach event, 626 Night Market, Arcadia, CA (Sept 2018).
- Volunteer**, Chemistry experiment demos, March for Science, Pasadena Memorial Park, Pasadena, CA (Mar 2017).
- Volunteer**, Judge for Caltech Summer Undergraduate Research Fellowship Seminar Day, Caltech, Pasadena, CA (Oct 2016).
- Caltech Jazz Band**, Performed for various Caltech fundraising and outreach events, Pasadena, CA (2013-2019).