

Curriculum Vitae — Alison E. Patteson

Contact Information

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Education

09/2016 **Ph. D.** Mechanical Engineering and Applied Mechanics
University of Pennsylvania
Dissertation *Particle, polymer, and phase dynamics in living fluids*
Thesis advisor: Paulo E. Arratia
American Physical Society Statistical and Non-linear Physics Dissertation Award
12/2014 **M. S.** Mechanical Engineering and Applied Mechanics
University of Pennsylvania
05/2011 **B. S.** Physics, *Summa Cum Laude with Honors*
B. S. Mathematics
Kutztown University of Pennsylvania

Academic Positions

Assistant Professor

01/2020-current BiInspired Institute Mechanics of Disease and Development Focus Group
Leader
01/2019 - current Physics Department, College of Arts and Sciences, Syracuse University

Research Assistant Professor

01/2018 Physics Department, College of Arts and Sciences, Syracuse University

Postdoctoral Researcher

10/2016– 12/2018 Department of Physiology, Perelman School of Medicine, and
Institute of Medicine and Engineering, University of Pennsylvania
Advisor: Paul A. Janmey

Awards

- 2021 **Outstanding Investigator Award**
NIH Maximizing Investigators' Research Award (MIRA)
- 2021 *Teaching Award*
Syracuse University Physics Department
- 2018 **Dissertation Award in Statistical and Non-linear Physics**
American Physical Society
- 2016 *John A. Goff Prize for Excellence in Research*
Faculty of Mechanical Engineering, University of Pennsylvania
- 2012–2015 **National Science Foundation Graduate Research Fellowship**
- 2011–2016 *Ashton Fellowship*
Full-tuition for graduate education, University of Pennsylvania
- 2011 *Syed R. Ali-Zaidi Award for Academic Excellence*
Pennsylvania State System of Higher Education
- 2011 *Chambliss Academic Achievement Award Gold Medal*
Kutztown University of Pennsylvania
- 2007 – 2011 *Board of Governors Scholarship*
Full-tuition for undergraduate education from the Pennsylvania State System of Higher Education

External Support

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|-------------|--------------|--|
| 2021 – 2026 | \$ 1,875,000 | NIH-R35-GM142963 (PI: Alison Patteson)
Role of vimentin in mammalian cell motility |
| 2020 – 2024 | \$ 697,000 | NSF-MCB-2026747 (PI: Alison Patteson)
Collaborative Research: Bacteria surface sensing and biofilm development |
| 2020 – 2023 | \$ 300,000 | NSF-DEB-2033942(PI: Alison Patteson)
EAGER: Emergent Collective Behavior in a Developmental Model |
| 2020 – 2022 | \$ 200,000 | NSF-MCB-2032861 (PI: Alison Patteson)
RAPID: What is the Role of Extracellular Vimentin in SARS2 Host Cell Entry? |

Publications

Submitted

5. J.A. Comstock, M.E. Asp, F. Bahar, I. Lee, A. E. Patteson, R.D. Welch, Phenotypic similarity as a measure of functional redundancy within homologous gene families, (Submitted).
bioRxiv: 2022.07.25.501402.
4. F. Alisafaei, K. Mandal, M. Swoger, P.A. Janmey, A.E. Patteson, V.B. Shenoy, Vimentin intermediate

filaments integrate actomyosin contractility with microtubule stiffness in cellular response to substrate mechanics. (Submitted). bioRxiv:2022.04.02.486829v1

3. R. Carroll, M. Thanh, A.E. Patteson. Dynamic remodeling of fiber networks with stiff inclusions under compressive loading. (Under Review). BioRxiv: 2022.08.04.502849.
2. E. Jutzeler, M. Asp, K. Kerr, D. Song, and A.E. Patteson, A torsion-based rheometer for measuring viscoelastic material properties. (In review, The Biophysicist). bioRxiv: 2020.09.16.288415
1. J. Tamayo, Y. Zhang, A.E. Patteson, A.M. Ardekani, A. Gopinath, Swarming bacterial fronts: Dynamics and morphology of active swarm interfaces propagating through passive frictional domains, (In review, Soft matter)

Published since joining Syracuse University

21. K. Pogoda, F.J. Byfield, P. Deptula, M. Ciesluk, L. Suprewicz, K. Sklodowski, J.L. Shivers, A. Oosten, K. Cruz, E. Tarasovets, E.L. Grishchuk, F.C. MacKintosh, R. Bucki, A.E. Patteson, P.A. Janmey, Unique role of vimentin networks in compression stiffening of cells and protection of nuclei from compressive stress. *Nano Letters* (2022).
20. M. Asp, M. Thanh, D. A. Germann, R.J. Carroll, A. Franceski, R.D. Welch, A. Gopinath, A.E. Patteson, Spreading rates of bacterial colonies depend on substrate stiffness and permeability. *PNAS Nexus* 1, pgac025 (2022).
19. A.E. Patteson, M.E. Asp, P.A. Janmey, Materials science and mechanosensitivity of living matter. *Applied Physics Reviews* 9, 011320 (2022).

Selected highlights: Applied Physics Reviews Featured Article

18. N. Krishnan, M. Swoger, M. Bates, J. Freshour, P. Fioramonti, A.E. Patteson, H. Hehnlly, Rab11 endosomes coordinate centrosome number and movement following mitotic exit. *Life Science Alliance* 5.7 (2022)
17. M. Swoger, S. Gupta, E.E. Charrier, M. Bates, H. Hehnlly, and A.E. Patteson, Vimentin intermediate filaments mediate cell shape on viscoelastic substrates. *ACS J. Appl. Bio Materials* 5, 2, 552-561 (2022).

Selected cover image

16. L. Suprewicz*, M. Swoger*, S. Gupta, E. Piktel, F. J. Byfield, D. V. Iwamoto, D. A. Germann, P.A. Janmey, J.M. Schwarz, R. Bucki*, A.E. Patteson*, Vimentin binds to SARS2 spike protein and antibodies targeting extracellular vimentin block uptake of SARS2 virus-like particles. *Small* 202105640 (2021).
15. A. Borzou A.E. Patteson, J.M. Schwarz, A data-driven statistical description for the hydrodynamics of active matter *New Journal of Physics* 23 103004 (2021).
14. S. Gupta, A.E. Patteson, J.M. Schwarz, Vimentin mediates bulk cell deformability and nuclear shape and position to affect cell speed and polarity in confinement. *New Journal of Physics*. 23 093042 (2021).
13. D. Song, J. Shivers, F.C. Mackintosh, A.E. Patteson, P.A. Janmey, Perspective: Cell-induced confinement effects in soft tissue mechanics. *J. Applied Physics* 129, 140901 (2021).
12. K. Liu, A.E. Patteson, E.J. Banigan, and J.M. Schwarz, Dynamic nuclear structure emerges from chromatin crosslinks and motors. *PRL*. 126, 158101 (2021).

Selected cover image

11. J. Singh*, A.E. Patteson*, P.K. Purohit, and P.E. Arratia, Sedimentation and diffusion of passive particles in active bacterial baths. *Soft matter* 17, 4151-4160 (2021)
10. A.E. Patteson, J. M. Schwarz, Nuclei as cytoplasmic rheometers. *Biophysical Journal* 120, 1-2, (2021).
9. Z. Ostrowska-Podhorodecka, I. Ding, W. Lee, J. Tanic, S. Abbasi, P.D. Arora, A.E. Patteson, P.A. Janmey, C.A. McCulloch, Vimentin tunes cell migration on collagen by controlling $\beta 1$ integrin activation and clustering. *JCB* 134 (6): jcs254359 (2021).
8. H. Li, T. Bague, A. Kirschner, R.W. Weisenthal, A.E. Patteson, N. Annabi, W. D. Stamer, P.S. Ganapathy, S. Herberg. A tissue-engineered human trabecular meshwork hydrogel for advanced glaucoma disease modeling. *Experimental Eye Research* 205, 108472 (2021).
7. A.E. Patteson, B.J. Carroll, D.V. Iwamoto, and P.A. Janmey. The vimentin cytoskeleton: When polymer physics meets cell biology. *Physical Biology* 8, 01100 (2020).
6. A.E. Patteson, A. Vahabikashi, R.D. Goldman, and P.A. Janmey. Mechanical and non-mechanical function of filamentous and non-filamentous vimentin. *Bioessays*, 2000078 (2020).

Selected cover image

5. M.C. Gandikota, K. Pogoda, A. van Oosten, T.A. Engstrom, A.E. Patteson, P.A. Janmey, and J.M. Schwarz, Loops versus lines and compression stiffening of cells. *Soft Matter*, (2020). arXiv:1908.03725
4. A.E. Patteson, K. Pogoda, F.J. Byfield, K. Mandal, Z. Ostrowska-Podhorodecka, E.E. Charrier, P.A. Galie, P. Deptula, R. Bucki, C.A. McCulloch, and P.A. Janmey. *Small*, 1903180 (2019).
3. A.E. Patteson*, A. Vahabikashi*, K. Pogoda, S.A. Adam, K. Mandal, M. Kittisopikul, S. Siyagurunathan, A. Goldman, R. Goldman, and P.A. Janmey. Vimentin protects cells against nuclear rupture and DNA damage during migration. *J. Cell Biol.* 201902046 (2019).
<https://doi.org/10.1101/566174>

Selected highlights: Nature, Syracuse University Arts & Sciences News

2. A.S.G. van Oosten, X. Chen, L. Chin, K. Cruz, A.E. Patteson, K. Pogoda, V. Shenoy, and P.A. Janmey. The emergence of tissue mechanics from confinement of non-linear biopolymer networks by densely packed cells. *Nature*, **573**, 96-101 (2019).
1. J. Yuang, P.E. Arratia, A.E. Patteson, and A. Gopinath, Quenching a swarm: Effects of light exposure on collective motility in swarming *Serratia marcescens*. *J.R. Soc. Interface* 16 (2019).
<https://doi.org/10.1101/331801>

Published prior to joining Syracuse University January 1, 2019

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7. A.E. Patteson, A. Gopinath, and P.E. Arratia, The propagation of active-passive interfaces in bacterial swarms. *Nature Communications*, 9, 5373 (2018). arXiv:1805.06429
 6. A.E. Patteson*, A. Gopinath*, and P.E. Arratia, Active colloids in complex fluids. *Current Opinion in Colloid & Interface Science*, 21, 86-96 (2016). arXiv:1602.02693
 5. A.E. Patteson, A. Gopinath, P.K. Purohit, and P.E. Arratia, Particle diffusion in active fluids is non-monotonic in size. *Soft Matter*, 12, 2365-2372 (2016). arXiv:1505:05803
 4. A.E. Patteson, A. Gopinath, M. Goulian, and P.E. Arratia, Running and tumbling with *E. coli* in polymeric solutions, *Scientific Reports*, 5, 15761 (2015). arXiv:1511.00708

Selected highlights: Penn Current, Phys.org, NSF News From the Field

3. A.E. Koser, N.C. Keim, and P.E. Arratia, Structure and dynamics of self-assembling colloidal monolayers in oscillating magnetic fields, *Physical Review E*, 88, 062304 (2013). arXiv:1311.4497
2. A.E. Koser, L. Pan, N.C. Keim, and P.E. Arratia, Measuring material relaxation and creep recovery in a microfluidic device, *Lab on a Chip*, 13, 1850 (2013).
1. A. Richardella, D.M. Zhang, J.S. Lee, A. Koser, D.W. Rench, A.L. Yeats, B.B. Buckley, D.D. Awschalom and N. Samarth, Coherent heteroepitaxy of Bi₂Se₃ on GaAs (111)B, *Applied Physics Letters*, 97, 262104 (2010). arXiv:1012.1918

* Equal contribution

Invited talks

- 2022 **Active Matter: The Next 25 Years 2022, Lorentz Center**, Leiden, Netherlands (Aug. 23, 2022)
Emergent collective behavior in a developmental model of fruiting body formation
 2022 Intermediate Filaments Gordon Research Conference, West Dover, VT (June 10, 2022)
Extracellular vimentin as a target against SARS-CoV-2 host cell invasion
- 2021 Connecting Intermediate Filaments Seminar Series, Presented virtually (Nov. 10, 2021)
Mechanobiology of Intermediate Filaments
 2021 AIChE Annual Meeting, Boston, MA (Nov. 8, 2021)
Bacterial Biofilms Sense and Response to Substrate Stiffness
 Biophysics and Physical Biology Seminar Series, Presented virtually (Sept. 27, 2021)
Mechanobiology of Vimentin Intermediate Filaments
- New and Notable presenter, Biophysical Society Meeting**, Presented virtually due to COVID-19 (Feb. 25, 2021)
Life of vimentin inside and outside the cell
 Joint Physics and Bioengineering Colloquia, UC Merced, Presented virtually due to COVID-19 (Jan. 22, 2021)
How cells cope with stress and handle COVID-19?
- The Physics of Living Matter, Princeton Center for Theoretical Science, Princeton University**, Princeton, NJ; Presented virtually (Jan. 13, 2021)
How do bacteria 'feel' their environment?
- 2020 **BioInspired Research: How does COVID-19 work and how can we stop it?**, BioInspired Institute Public Lecture, Syracuse University, Syracuse, NY; Presented virtually due to COVID-19 (Nov. 28, 2020)
How physics can help in the fight against COVID-19
- 11th Physics of Cancer Symposium**, University of Leipzig, Germany; Presented virtually due to COVID-19 (Sept. 23, 2020)
Vimentin as a regulator of nuclear and cellular dynamics

Center of Engineering Mechanobiology, University of Pennsylvania, Philadelphia, PA; Presented virtually

Vimentin as a regulator of nuclear and cellular dynamics

Active Matter at the Frontier, Kavli Institute for Theoretical Physics, Prepared for Santa Barbara, CA (April 7, 2020); In-person even cancelled due to COVID-19

Emergent and collective motion at the micron scale

American Physical Society March Meeting, Prepared for Denver, CO; Presented Virtually due to COVID-19 (March 3, 2020)

3D Cell Motility: A look at the intermediate filament cytoskeleton

Department of Mechanical and Aerospace Engineering, Syracuse University, Syracuse, NY

3D Cell Motility: A look at the intermediate filament cytoskeleton

BioArt Mixer, Canary Lab, Syracuse University, Syracuse, NY

Life in suspense

2019 Syracuse University Project Advance (SUPA) Seminar for high school physics teachers, Syracuse, NY and New York, NY

The soft matter physics of small moving cells

Dentistry Collagen Group Seminar Series, University of Toronto, Toronto, Canada

3D Cell Motility: A look at the intermediate filament cytoskeleton

Syracuse Biomaterials Institute Seminar, Syracuse University, Syracuse, NY

3D Cell Motility: A look at the intermediate filament cytoskeleton

Fibrous Networks in Biology Meeting, University of Pennsylvania, Philadelphia, PA

Confined cell migration: A look at the cytoskeleton

Physics Seminar, State University of New York College at Cortland, Cortland, NY

Physical limits of cell migration

GFS follow on: Mathematics of form in active and inactive media, Isaac Newton Institute for Mathematical Sciences, Cambridge, United Kingdom

Physical limits of cell migration

Biophysics and Soft Matter Seminar, Department of Physics, Syracuse University, Syracuse NY

Push and pull: Mechanical forces that guide cell motility

2018 **Andrew P. Somlvo Honorary Lectures**, Pennsylvania Muscle Institute, University of Pennsylvania, Philadelphia, PA

Vimentin controls 3D migration and protects the nucleus from damage

University of Pennsylvania, Physical Sciences Oncology Center, Philadelphia, PA

Vimentin intermediate filaments hinder 3D cell migration and protect against compressive forces

APS GNSP Dissertation Award, American Physical Society (APS) Annual Meeting (March), Los Angeles, California (2018)

Life in Suspense: Particle dynamics in suspensions of swimming bacteria

2017 **3rd International Symposium on Mechanobiology, Singapore**

Loss of vimentin increases motility and nuclear damage in confined spaces

University of Pennsylvania, Physical Sciences Oncology Center, Philadelphia, PA

Role of vimentin intermediate filaments in 3D cell migration

Pennsylvania State University, Chemical Engineering Department, State College, PA

Life in suspense: Particle dynamics in suspensions of swimming bacteria

Syracuse University, Department of Physics, Syracuse, NY

Life in suspense: Particle dynamics in suspensions of swimming bacteria

2016 SIAM Annual Meeting, Boston, MA

Swimming in Complex Fluids: Experiments with Model Organisms

Life in suspense: Particle dynamics in active fluids

Professional Activities and Outreach

- 2022 Co-organizer and Chair, APS March Meeting Biological Active Fluids Session
- 2020 Public Lecture, BioInspired Institute Public Lecture, November
- 2020 Public Lecture, BioArt Mixer, January
- 2020 NIH Early Career Reviewer
- 2020- NSF Reviewer
- 2015- Reviewer – Scientific Reports, PNAS, Nature Communications, Nucleus, Current Opinion in Colloid & Interface Science, Soft Matter, Experimental Fluids, Research in Microbiology, Phys Rev E, Biophysical Journal, Physics of Fluids

Teaching

Teaching Certificates

Spring 2015 Certificate in College and University Teaching, University of Pennsylvania

Teaching **Syracuse University**, Syracuse, NY USA

- Fall 2019 *Physics 360* Vibration, Waves, and Optics
- Spring 2020 *Physics 212* General Physics II – Electricity, Magnetism, & Light
- Fall 2020 *Physics 360* Vibration, Waves, and Optics
- Spring 2021 *Physics 212* General Physics II – Electricity, Magnetism, & Light
- Fall 2021 *Physics 360* Vibration, Waves, and Optics
- Spring 2022 *Physics 212* General Physics II – Electricity, Magnetism, & Light
- Fall 2022 *Physics 250* Physics Journal Workshop

Ph.D. Students Supervised

Expected 2022	Merrill Asp
Expected 2023	Sarthak Gupta
Expected 2024	Maxx Swoger
Expected 2025	Renita Saldanha
Expected 2026	Nuzhat Nufa

Postdoctoral Associates

2019-Present	Bobby Carroll	Ph.D. University of Tennessee-Knoxville 2019
2020-Present	Minh Tri Ho Thanh	Ph.D. WPI 2020
2023-Present	Subarna Dutta	Ph.D. University of Calcutta 2021

Conferences & Contributed Talks

- 11th European Meeting on Intermediate Filaments, Rolduc, Netherlands (2021)
Extracellular vimentin: New role as SARS-CoV-2 co-receptor (Poster)
- American Physical Society (APS) Annual Meeting (March), held virtually due to pandemic(2021)
How does SARS-CoV-2 invade host cells and how can we block it?
- Magnetism and Life Workshop, Riga, Latvia (2019)
Emergent and collective motion at the micron scale
- American Physical Society (APS) Annual Meeting (March), Boston, Massachusetts (2019)
Vimentin controls 3D migration and protects the nucleus from damage
- 9th Annual Symposium Physics of Cancer, Leipzig, Germany (2018)
Vimentin controls 3D migration and protects the nucleus from damage
- Mechanobiology Symposium, Center for Engineering MechanoBiology (CEMB), University of Pennsylvania, Philadelphia, Pennsylvania (2018)
Loss of vimentin intermediate filaments decreases peri-nuclear stiffness and enhances cell motility through confined spaces (Poster)
- Generation and Control of Forces in Cells, Nordita, Stockholm, Sweden (2018)**
A hitchhiker's guide to cell motility: Nonlinear physics approach to swimming bacteria and crawling cells
- American Physical Society (APS) Annual Meeting (March), Los Angeles, California (2018)
The propagation of active-passive interfaces in bacterial swarms
- American Society for Cell Biology (ASCB) | European Molecular Biology Organization (EMBO) Annual Meeting, Philadelphia, Pennsylvania (2017)
Loss of vimentin increases motility and nuclear damage in confined spaces (Poster)
- 16th Mid-Atlantic Soft Matter Workshop, Philadelphia, Pennsylvania (2017)
Vimentin intermediate filaments and their role in cell migration (Soundbite)
- 4th Biophysical Society Pennsylvania Network Meeting, Lehigh University, Lehigh, Pennsylvania (2016)
Running and tumbling with E. coli in polymeric solutions (Poster)
- American Physical Society (APS) Annual Meeting (March), Baltimore, Maryland (2016)
Non-monotonic size-dependent particle diffusion in active fluids
Swimming and transport of bacteria in time-periodic flows (Poster)
Best Poster Award from the Division of Biological Physics, American Physical Society

13. 68th American Physical Society Division of Fluid Dynamics (DFD) Annual Meeting, Boston, Massachusetts (2015)
Non-classical size-dependent particle diffusion in active fluids
Running and tumbling with E. coli in polymeric solutions
14. Gordon Research Conference (GRC): Soft Condensed Matter Physics, New London, New Hampshire (2015)
Running and tumbling with E. coli in polymeric solutions (Poster)
15. American Physical Society (APS) Annual Meeting (March), San Antonio, Texas (2015)
Suppression of E. coli tumbling and wobbling in dilute polymeric fluids
16. Society of Rheology (SOR) Philadelphia, Pennsylvania (2014)
Swimming dynamics of Escherichia coli in dilute polymer suspensions
17. 88th ACS Colloid and Surface Science Symposium, Philadelphia, Pennsylvania (2014)
Structure and dynamics of self-assembling colloidal monolayers in oscillating magnetic fields
Swimming dynamics of Escherichia coli in dilute polymer suspensions
18. Society of Women Engineers (SWE) Poster Competition, Philadelphia, Pennsylvania (2013)
Material relaxation in a microfluidic device (Poster)
19. 12th Mid-Atlantic Soft Matter Workshop, Philadelphia, Pennsylvania (2013)
Material relaxation in a microfluidic device (Soundbite)
20. 66th American Physical Society Division of Fluid Dynamics (DFD) Annual Meeting, Pittsburgh, Pennsylvania (2013)
Structure and dynamics of self-assembling colloidal monolayers in oscillating magnetic fields
Self-assembling paramagnetic colloids in oscillating magnetic fields (Gallery of Fluid's Motion Video—arXiv:1310.3212)
21. American Physical Society (APS) Annual Meeting (March), Portland, Oregon (2010)
Cluster formation in a Freely-Falling Granular Stream (Poster)
22. American Physical Society (APS) Annual Meeting (March), Pittsburgh, Pennsylvania (2009)
transition of Two Dimensional Hard Spheres From the Liquid to Solid State Using a Global Equation of State (Poster)
23. Quadrennial Congress of Sigma Pi Sigma, Fermilab, Batavia, Illinois (2008)
The transition of Two Dimensional Hard Spheres From the Liquid to Solid State Using a Global Equation of State (Poster)
24. American Physical Society (APS) Annual Meeting (March), New Orleans, Louisiana (2008)
The transition of two-dimensional hard spheres from liquid to solid regimes under gravity using a global equation of state (Poster)