Stephen J. DeCamp, PhD

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SUMMARY

An innovative, cross-functional, and creative scientist with strong communication skills and over 13 years of experimental physics research experience. Primary focus leverages the quantitative sciences to elucidate complex bio-material processes using novel optical instrumentation and innovative hardware solutions. Balances high-level and broad-view strategy simultaneously with in-the-weeds details. Track-record of successfully employing image and data analytics to achieve high-impact advances in the field. As an experimentalist, I approach research problems with an open mind for creative solutions, a collaborative, team-oriented attitude, and a sense of humor.

RESEARCH & WORK EXPERIENCE

Harvard T.H. Chan School of Public Health **Boston, MA**
Research Associate **September 2019 – Present**
Postdoctoral Research Fellow **September 2016 – August 2019**

- Led a project focusing on the interface of materials science, physics, and biology. This project generated high-impact results published in *Scientific Reports* and shows that a fundamental shift in cell metabolism occurs during the mechanical transition to epithelial cell migration. In this project, I merged optical techniques, materials engineering, biomarkers, and Matlab-based analysis to simultaneously quantify biophysical quantities (metabolic and mechanical) from millions of cells.
- Managed a multidisciplinary team of software developers, medical students, and physicists. Initiated and led a project through ideation, strategy, and experimental design, analysis, and publication.
- Designed and fabricated novel cell culture assay system for mechano-bio-energetic studies.
- Designed and coded image analysis pipelines to extract numerous biophysical features from microscopy images; such as cell tracking, segmentation, biomarker and immunofluorescence quantification.
- Established proof-of-concept process to investigate relationships between tissue mechanics and immune cell infiltration from human-derived tumor histological sections.
- Founded and led a Boston-based meetup group (Boston Soft Matter Socials) that fostered synergy between researchers with diverse backgrounds ranging from physics, math, engineering, and biology.

Brandeis University **Waltham, MA**
Graduate Research Associate **September 2010 – August 2016**

- Pioneered novel bioengineered materials, spawning a new area of physics in active matter research. This project directly resulted in 6 high-impact co-author publications, and inspired dozens more in the field. In this project, I assembled reconstituted biopolymers and molecular motors to build active biomaterials. I discovered a previously unpredicted phenomena in active nematic liquid crystals whereby self-propelled defects spontaneously align and reorient throughout the material.
- Expertise in custom experimental instrumentation and hardware including custom optical assemblies, rapid prototyping using microfabrication techniques, and assembling innovative apparatuses for sample production resulting in high-volume sample creation and big-data set generation.
- Innovated experimental and analytical protocols now used ubiquitously throughout the field.
- Coded novel algorithms for defect orientation analysis and microtubule filament tracking, including statistical analysis, to quantify material science properties in novel biological-based active materials.
- Instructed experts and non-experts on proper experimental and analysis procedures.

Michigan State University **East Lansing, MI**
Undergraduate Research Assistant **August 2006 – May 2010**

- Experimentally investigated secondary structure formation during protein folding using ultra-rapid microfluid mixers and custom optical microscopes. These experiments provide a novel platform for generating time-resolved protein folding data by integrating concepts in physics with molecular biology.
- Built a confocal circular dichroism spectroscopy microscope using custom LabView programming, optics, and hardware integrated with a microfluidic serpentine mixer. This instrumentation project demonstrated protein secondary structure formation measurement within a 100-microsecond timescale.
- Employed hard-contact photolithography, polysilicon deposition, and high-aspect ratio silicon wafer etching with D-RIE methods for microfluidic fabrication. Using microfabrication techniques, I produced silica-based microfluidic devices for protein folding studies.

EDUCATION & TRAINING

Harvard School of Public Health, Postdoctoral Fellow (Trainee) September 2016 – August 2019
Molecular and Integrative Physical Sciences Program
Supervisor: Dr. Jeffrey J. Fredberg

Brandeis University, PhD. in Physics September 2010 – August 2016
Attachment: Quantitative biology
Supervisor: Dr. Zvonimir Dogic
Dissertation Title: *Dynamics of Active Nematic Liquid Crystals*

Michigan State University, B.S. in Physics and Astrophysics August 2006 – May 2010
Supervisor: Dr. Lisa Lapidus
Thesis Title: *Circular Dichroism Measurements in a Microfluidic Serpentine Mixer*

PUBLICATIONS

My research has resulted in 13 peer reviewed publications many of which are in high impact journals such as *Nature*, *Nature Materials*, and *Science*. My publications have been cited over 1700 times since 2015.

DeCamp, S. J., Tsuda, V. M. K., Ferruzzi, J., Koehler, S. A., Giblin, J. T., Roblyer, D., Zaman, M. H., Weiss, S. T., DeMarzio, M., Park, C. Y., Ogassavara, N. C., Mitchel, J., Butler, J. P. & Fredberg, J. J. Epithelial layer unjamming shifts energy metabolism toward glycolysis. *Scientific Reports* 10, 18302 (2020).

Mitchel, J. A., Das, A., O'Sullivan, M. J., Stancil, I. T., **DeCamp, S. J**., Koehler, S., Ocaña, O. H., Butler, J. P., Fredberg, J. J., Nieto, M. A., Bi, D. & Park, J.-A. In primary airway epithelial cells, the unjamming transition is distinct from the epithelial-to-mesenchymal transition. *Nature Communications* 11, 5053 (2020).

Lemma, L. M., **DeCamp, S. J**., You, Z., Giomi, L. & Dogic, Z. Statistical properties of autonomous flows in 2D active nematics. *Soft Matter* 15, 3264–3272 (2019).

Atia, L., Bi, D., Sharma, Y., Mitchel, J. A., Gweon, B., A. Koehler, S., **DeCamp, S. J**., Lan, B., Kim, J. H., Hirsch, R., Pegoraro, A. F., Lee, K. H., Starr, J. R., Weitz, D. A., Martin, A. C., Park, J.-A., Butler, J. P. & Fredberg, J. J. Geometric constraints during epithelial jamming. *Nature Physics* 14, 613–620 (2018).

Sharma, Y., Atia, L., Rhodes, C. S., **DeCamp, S. J**., Mitchel, J. & Fredberg, J. J. Scaling Physiologic Function from Cell to Tissue in Asthma, Cancer, and Development. *Annals ATS* 15, S35–S37 (2018).

Wu, K.-T., Hishamunda, J. B., Chen, D. T. N., **DeCamp, S. J**., Chang, Y.-W., Fernández-Nieves, A., Fraden, S. & Dogic, Z. Transition from turbulent to coherent flows in confined three-dimensional active fluids. *Science* 355, 1979 (2017).

DeCamp, S. J., Redner, G. S., Baskaran, A., Hagan, M. F. & Dogic, Z. Orientational order of motile defects in active nematics. *Nature Materials* 14, 1110–1115 (2015).

Henkin Gil, DeCamp Stephen J., Chen Daniel T. N., Sanchez Tim & Dogic Zvonimir. Tunable dynamics of microtubule-based active isotropic gels. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 372, 20140142 (2014).

Keber, F. C., Loiseau, E., Sanchez, T., **DeCamp, S. J**., Giomi, L., Bowick, M. J., Marchetti, M. C., Dogic, Z. & Bausch, A. R. Topology and dynamics of active nematic vesicles. *Science* 345, 1135–1139 (2014).

Lapidus, L. J., Acharya, S., Schwantes, C. R., Wu, L., Shukla, D., King, M., **DeCamp, S. J**. & Pande, V. S. Complex Pathways in Folding of Protein G Explored by Simulation and Experiment. *Biophysical Journal* 107, 947–955 (2014).

Sanchez, T., Chen, D. T. N., **DeCamp, S. J**., Heymann, M. & Dogic, Z. Spontaneous motion in hierarchically assembled active matter. *Nature* 491, 431–434 (2012).

DeCamp, S. J., Naganathan, A. N., Waldauer, S. A., Bakajin, O. & Lapidus, L. J. Direct Observation of Downhill Folding of λ-Repressor in a Microfluidic Mixer. *Biophysical Journal* 97, 1772–1777 (2009).

Waldauer, S. A., Bakajin, O., Ball, T., Chen, Y., **DeCamp, S. J**., Kopka, M., Jäger, M., Singh, V. R., Wedemeyer, W. J., Weiss, S., Yao, S. & Lapidus, L. J. Ruggedness in the folding landscape of protein L. *HFSP Journal* 2, 388–395 (2008).

SKILLS

Computational: Matlab. ImageJ. Mathematica. Ilastik Machine Learning. Leica LASX. MicroManager. LabView. - Skilled in image analysis for object detection, flow tracking (PIV), traction force analysis, cell morphology segmentation analysis, and cell tracking. Extensive work in data plotting, visualization for data analysis, image processing, and statistical analysis.

Optics/Microscopy: Fluorescence, laser confocal, phase, CD spectroscopy, TIRF, and polarization light microscopy. - Experience in designing and building optical systems for applications in bio-materials imaging.

Microfabrication: photolithography, clean-room techniques, rapid PDMS microfluidic prototyping.

Wetlab Biology: Mammalian cell culture. Transfection. Sample fixation. Protein purification. Plasmid DNA work. Epithelial tissue bioengineering. Biosensor implementation and calibration (i.e., Peredox Redox biosensor). Glucose uptake assay. Mitochondrial membrane potential assay.

Administrative: Microsoft Office Suite (Word, Excel, PowerPoint). Adobe Illustrator. Grant writing. Publication preparation. - Excellence in scientific communication and presentation in both written and spoken formats.

PERSONNEL MANAGEMENT & MENTORSHIP

Lehman Foundation Research Mentor 2018-2019
Supervised 2 student research projects and mentored career development activities

Harvard University Science Education Undergraduate Mentoring Workshop Series 2018
Earned a certificate in undergraduate research mentorship from esteemed Harvard program

HHMI Quantitative Biology Research Community Mentor 2015
Mentored 6 students in a laboratory-based experiential learning program

Active Sample Bootcamps for the Brandeis NSF MRSEC 2012-2015
Trained dozens of external researchers in active sample preparation

Undergraduate Research Mentor in the Dogic Lab at Brandeis University 2012-2015
Supervised 3 undergraduates resulting in 1 publication

Teaching Assistant for Introduction to Physics Lab at Brandeis University 2010-2011
Instructed a physics lab designed for pre-med students to learn concepts in physics.

GRANTS, AWARDS, & HONORS

K25 Grant for Mentored Quantitative Research Development Award - Submitted 2019
National Heart, Lung, Blood Institute, National Institutes of Health

Early Career Meeting Grant Recipient for BostonSoftMatter.com, Founder and Co-Organizer 2017
American Society for Cell Biology (ASCB)

NHLBI T32 Training Grant in the Molecular and Integrative Physical Science Program 2016-2019
Harvard T.H.Chan School of Public Health

Dr. Stephan Berko Prize, 23rd Berko Symposium 2014
Brandeis University, Waltham, MA

Andor/Bitplane Insight Award for best microscopy image 2013
Brandeis University, Waltham, MA

NIBIB Quantitative Biology Training Grantee in Quantitative Biology 2011-2012
Brandeis University, Waltham, MA

CONFERENCE TALKS

Physical Sciences Oncology Network Junior Investigator Meeting – Bethesda, MD August 2019
Squishy Physics Seminar – **Invited Speaker** – Harvard University, Cambridge, MA July 2019
ATS Annual Meeting – Dallas, TX May 2019
APS March Meeting – Boston, MA March 2019
Harvard School of Public Health – Environmental Health Department Retreat, Boston, MA December 2018
8th World Congress of Biomechanics – Dublin, Ireland July 2018
APS March Meeting – Baltimore, MD March 2016
Soft Condensed Matter Seminar – Tufts University, Medford, MA October 2015

Gordon Research Seminar (GRS) Soft Matter – Colby-Sawyer College, NH	August 2015
APS March Meeting – San Antonio, TX	March 2015
ACS Active Colloids Meeting – University of Pennsylvania, Philadelphia, PA	June 2014
23rd Berko Symposium – **Berko Prize Award** – Brandeis University, Waltham MA	May 2014
APS March Meeting – Denver, CO	March 2014
QB/MSM Student Talk Seminar – Brandeis University, Waltham MA	February 2014
15th Annual Greater Boston Area Statistical Mechanics Meeting (GBASM)	October 2013
Gordon Research Conference (GRC) Liquid Crystals – U. of New England, ME	June 2013
22nd Berko Symposium – Brandeis University, Waltham MA	June 2013
Brandeis Biochem, Biophys, & QB Annual Retreat – MBL, Woods Hole, MA	October 2012
52nd New England Complex Fluids – Brandeis University, Waltham MA	September 2012
NIH NIBIB Training Grantees Meeting – NIH Campus, Bethesda, MD (poster)	June 2012
QB/MSM Student Talk Seminar – Brandeis University, Waltham MA	May 2012
Active Jammed Systems – New York University, New York, NY (poster)	May 2012

SCIENCE OUTREACH

Boston Soft Matter Socials – Co-founder and organizer	2016-2019
Organized Biological Soft Matter Meeting Nov 17, 2017 @MIT	2017
Stratton Elementary School Science Festival – Arlington, MA	2014- 2015
Acton Discovery Museum – tabletop demos – Acton, MA	2011-2014
Lawrence Science Program – Intensive MCAS Science Bootcamp – classroom lessons	2014
Geek is Glam – Girl Scout Camp Event – stage demos – Worcester, MA	2013
Boston Children's Museum – Tinker Tent – Electricity and Circuits Demo	2013
Boston Common Halloween at Frog Pond – Boston, MA	2013
PBS/NOVA – Making Stuff – tabletop demos – Boston Museum of Science	2011

ADMINISTRATIVE RESPONSIBILITIES

Lab Manager & Lab Safety Officer – Fredberg Lab – HSPH, Boston, MA	2017-2020
Principal Investigator (PI) – NIH K25 – Submission	2019
Principal Investigator (PI) – American Society for Cell Biology Early Career Meeting Grant	2017
Lab Safety Coordinator – Dogic Lab – Brandeis University, Waltham, MA	2012-2016