

Derin Sevenler, PhD

Instructor (1/2023-), Center for Engineering in Medicine and Surgery

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Education and Training

2018-2022 Postdoctoral Research Fellow, Center for Engineering in Medicine & Surgery
Massachusetts General Hospital and Harvard Medical School
Advisor: Mehmet Toner

2017 PhD, Biomedical Engineering
Boston University
Advisor: M. Selim Ünlü

2011 BS, Mechanical & Aerospace Engineering
Cornell University
Advisor: Lawrence Bonassar

Awards and Honors

2022 NIAID K99/R00 Pathway to Independence Award

2014 Fellow, NIH Cross-Training Program in Nanotechnology and Cancer

2013 Fellow, ED Graduate Assistance in Areas of National Need

2012 Fellow, NIH T31 Quantitative Biology & Physiology Training Program

Sponsored Research

2022-2026 Intracellular delivery of DNA-editing proteins by viscoelastic cell stretching
NIH NIAID 1K99AI167063-01A1 – Pathway to Independence Award
PI (\$549,000 direct costs)
This project seeks to develop a very fast microfluidic method of permeabilizing the plasma membrane of mammalian cells ex vivo for transfection of DNA-editing proteins.

2023-2024 Microfluidic intracellular delivery of glass formers for neutrophil preservation
NSF Stakeholder Inspired Research Project, ATP-Bio Engineering Research Center
PI (\$25,000 direct costs)
This project is focused on intracellular delivery of trehalose to neutrophils using a microfluidic device, towards the goal of enabling neutrophil preservation by vitrification.

2016-2018 NSF Industry/University Collaborative Research Center for Biophotonic Sensors and Systems
SCIENION, AG
Significant Contributor (\$100,000 direct costs)
The goal of this project is to develop an interferometric reflectance imaging system for automated and label free quality assurance of microprinted DNA and protein microarrays.

Peer Reviewed Publications

Google Scholar profile: <https://scholar.google.com/citations?user=2QAce2gAAAAJ>

1-18

- (1) Sevenler, D.; Toner, M. High Throughput Intracellular Delivery by Viscoelastic Mechanoporation. *Nat Commun* **2024**, *15* (1), 115. <https://doi.org/10.1038/s41467-023-44447-w>.
- (2) Jaskiewicz, J. J.; Dayao, D. A. E.; Girouard, D.; Sevenler, D.; Widmer, G.; Toner, M.; Tzipori, S.; Sandlin, R. D. Scalable Cryopreservation of Infectious *Cryptosporidium Hominis* Oocysts by Vitrification. *PLOS Pathogens* **2023**, *19* (6), e1011425. <https://doi.org/10.1371/journal.ppat.1011425>.
- (3) Rein, C.; Toner, M.; Sevenler, D. Rapid Prototyping for High-Pressure Microfluidics. *Sci Rep* **2023**, *13* (1), 1–9. <https://doi.org/10.1038/s41598-023-28495-2>.
- (4) Ekiz Kanik, F.; Celebi, I.; Sevenler, D.; Tanriverdi, K.; Lortlar Ünlü, N.; Freedman, J. E.; Ünlü, M. S. Attomolar Sensitivity microRNA Detection Using Real-Time Digital Microarrays. *Sci Rep* **2022**, *12* (1), 16220. <https://doi.org/10.1038/s41598-022-19912-z>.
- (5) Sevenler, D.; Niu, X.; Dossantos, S.; Toner, M.; Cressey, T. R.; Sandlin, R. D.; Drain, P. K. Point-of-Care Semi-Quantitative Test for Adherence to Tenofovir Alafenamide or Tenofovir Disoproxil Fumarate. *Journal of Antimicrobial Chemotherapy* **2022**, *77* (4), 996–999. <https://doi.org/10.1093/jac/dkab487>.
- (6) Sevenler, D.; Bean, H.; Toner, M.; Sandlin, R. D. Slow-Delivery and Distributed Exchange of Cryoprotective Agents with Hydrogel Beads. *Cryobiology* **2021**. <https://doi.org/10.1016/j.cryobiol.2021.09.006>.
- (7) Olanrewaju, A. O.; Sullivan, B.; Gim, A.; Sevenler, D.; Bender, A.; Drain, P.; Posner, J. REVerSe TRanscriptase Chain Termination (RESTRICT) for Selective Measurement of Nucleotide Analogs Used in HIV Care and Prevention. **2021**. <https://doi.org/10.33774/chemrxiv-2021-q65sr>.
- (8) Sevenler, D.; Bardon, A.; Fernandez Suarez, M.; Marshall, L.; Toner, M.; Drain, P.; Sandlin, R. D. Immunoassay for HIV Drug Metabolites Tenofovir and Tenofovir Diphosphate. *ACS Infect. Dis.* **2020**, *6* (7), 1635–1642. <https://doi.org/10.1021/acsinfecdis.0c00010>.
- (9) Olanrewaju, A. O.; Sullivan, B. P.; Zhang, J.; Bender, A. T.; Sevenler, D.; Lo, T. J.; Fernandez-Suarez, M.; Drain, P. K.; Posner, J. D. An Enzymatic Assay for Rapid Measurement of Antiretroviral Drug Levels. *ACS Sens.* **2020**. <https://doi.org/10.1021/acssensors.9b02198>.
- (10) Jaskiewicz, J. J.; Sevenler, D.; Swei, A. A.; Widmer, G.; Toner, M.; Tzipori, S.; Sandlin, R. D. Cryopreservation of Infectious *Cryptosporidium Parvum* Oocysts Achieved through Vitrification Using High Aspect Ratio Specimen Containers. *Sci Rep* **2020**, *10* (1), 11711. <https://doi.org/10.1038/s41598-020-68643-6>.
- (11) Sevenler, D.; Trueb, J.; Ünlü, M. S. Beating the Reaction Limits of Biosensor Sensitivity with Dynamic Tracking of Single Binding Events. *PNAS* **2019**, 201815329. <https://doi.org/10.1073/pnas.1815329116>.
- (12) Sevenler, D.; Daaboul, G. G.; Ekiz Kanik, F.; Ünlü, N. L.; Ünlü, M. S. Digital Microarrays: Single-Molecule Readout with Interferometric Detection of Plasmonic Nanorod Labels. *ACS Nano* **2018**, *12* (6), 5880–5887. <https://doi.org/10.1021/acsnano.8b02036>.
- (13) Trueb, J.; Avci, O.; Sevenler, D.; Connor, J. H.; Ünlü, M. S. Robust Visualization and Discrimination of Nanoparticles by Interferometric Imaging. *IEEE Journal of Selected Topics in Quantum Electronics* **2017**, *23* (2), 1–10. <https://doi.org/10.1109/JSTQE.2016.2639824>.
- (14) Sevenler, D.; Avci, O.; Ünlü, M. S. Quantitative Interferometric Reflectance Imaging for the Detection and Measurement of Biological Nanoparticles. *Biomed. Opt. Express, BOE* **2017**, *8* (6), 2976–2989. <https://doi.org/10.1364/BOE.8.002976>.
- (15) Ekiz-Kanik, F.; Sevenler, D. D.; Ünlü, N. L.; Chiari, M.; Ünlü, M. S. Surface Chemistry and Morphology in Single Particle Optical Imaging. *Nanophotonics* **2017**, *6* (4), 713–730. <https://doi.org/10.1515/nanoph-2016-0184>.
- (16) Scherr, S. M.; Daaboul, G. G.; Trueb, J.; Sevenler, D.; Fawcett, H.; Goldberg, B.; Connor, J. H.; Ünlü, M. S. Real-Time Capture and Visualization of Individual Viruses in Complex Media. *ACS Nano* **2016**, *10* (2), 2827–2833. <https://doi.org/10.1021/acsnano.5b07948>.
- (17) Sevenler, D.; Ünlü, M. S. Numerical Techniques for High-Throughput Reflectance Interference Biosensing. *Journal of Modern Optics* **2015**, *0* (0), 1–6. <https://doi.org/10.1080/09500340.2015.1117668>.
- (18) Sevenler, D.; Buckley, M. R.; Kim, G.; van der Meulen, M. C. H.; Cohen, I.; Bonassar, L. J. Spatial Periodicity in Growth Plate Shear Mechanical Properties Is Disrupted by Vitamin D Deficiency. *Journal of Biomechanics* **2013**, *46* (10), 1597–1603. <https://doi.org/10.1016/j.jbiomech.2013.04.023>.

Non-peer reviewed scholarship

- (19) Drain, P. K.; Bardon, A. R.; Simoni J. M.; Cressey T. R.; Anderson P. A.; **Sevenler D.**; Olanrewaju A. O.; Gandhi M.; Celum C. Point-of-care and near real-time testing for antiretroviral adherence monitoring to HIV treatment and prevention. Springer, US; **2020**. 487-498.
- (20) **Sevenler, D.**; Ünlü, N. L.; Ünlü, M. S. Nanoparticle Biosensing with Interferometric Reflectance Imaging. In: Nanobiosensors and Nanobioanalyses. Springer, Tokyo; **2015**. 81–95.

Teaching

- Spring 2023 Teaching Assistant, Harvard University “Fluid Mechanics and Transport Phenomena”
- Fall 2013 Teaching Assistant, Boston University “Fluid Mechanics”
- Spring 2013 Teaching Assistant, Boston University “Structural Mechanics”

Service

- 2023- Mentor, MGH Youth Scholars Program
- 2021 Judge, Berkeley Bioengineering High School Competition
- 2020- Mentor, Massachusetts General Postdoc Association Mentoring Program
- 2020-2022 Founding member, Student Leadership Committee, ATP-Bio NSF Engineering Research Center
- 2020-2021 Analyst, Horizon Technologies Working Group, Mass General Brigham Center for COVID Innovation
- 2012-2015 Founding member, Boston University Biomedical Engineering Graduate Student Committee

Invited Talks

- 2023 “High throughput intracellular delivery by viscoelastic mechanoporation”
Squishy Physics seminar series, Harvard Department of Physics, Cambridge, MA
- 2018 “Interferometric Biosensing for Sensitive Molecular Diagnostics”
Advances in Interferometry Workshop, IEEE Photonics Boston Chapter, MIT Lincoln Laboratory, Lexington, MA
- 2018 “Single-molecule microarrays with interferometric detection of plasmonic labels”
Boston University Optical Society of America/SPIE Chapter Meeting, Boston, MA

Presentations at Professional Meetings

- 2023 “High throughput intracellular delivery by viscoelastic mechanoporation”
Oral presentation, Biomedical Engineering Society Annual Meeting, Seattle, WA
- 2023 “High throughput intracellular delivery by viscoelastic mechanoporation”
Poster presentation, Gordon Research Conference on Advanced Biomanufacturing, Newry, ME
- 2020 “Programmable uptake and release of cryoprotective agents from semipermeable hydrogels”
Oral presentation, Society of Cryobiology Annual Meeting (virtual)
- 2018 “A digital microarray for transcriptional biomarkers of antibiotic resistance”
Oral Presentation, SPIE Photonics West BIOS, San Francisco, CA
- 2018 “High throughput genomic and transcriptomic analysis with single molecule readout”
Poster presentation, Gordon Research Conference on Liquid Biopsy for Cancer, Hadley, MA
Outstanding Poster Award

- 2017 “Direct quantification of low-concentration protein and nucleic acid biomarkers with interferometric detection of nanoparticle labels”
Poster presentation, IEEE Special Topics Conference on Healthcare Innovations and Point-of-Care Technologies, Bethesda, MD
- 2014 “Enhanced interferometric detection of individual nanorods for multiplexed sensitive molecular assays”
Poster Presentation, Biomedical Engineering Society Annual Meeting, San Antonio, TX
- 2011 “Vitamin D Deficiency Disturbs the Shear Strain Profile of the Growth Plate”
Oral Presentation, Biomedical Engineering Society Annual Meeting, Hartford, CT

Patents

- (1) “High aspect ratio devices and methods for vitrification of samples by rapid cooling” Patent Application No. 2020/30365914 (November 16, 2023)
- (2) “Viscoelastic mechanoporation systems and methods of use thereof” Patent Application No. 2022/012098 and WO/2022/155186 (July 21, 2022)
- (3) “Enzymatic assay to measure long-term adherence to pre exposure prophylaxis and antiretroviral therapy” Patent Application No. 2022/030/7066 and WO/2020/252399 (December 17, 2020)
- (4) “Systems and methods for imaging microwell plate samples” **US Patent 10,585,042** (December 12, 2019)
- (5) “Dynamic tracking of captured targets for enhanced digital biosensing” Patent Application No. 2019/0339268 (November 7, 2019)
- (6) “Method and system for enhanced single particle reflectance imaging” **US Patent 11,047,790** (May 30, 2019)
- (7) “Disposable fluidic cartridge for interferometric reflectance imaging” Patent Application No. 2021/0069706 (December 12, 2018)

Professional Societies

Biomedical Engineering Society (BMES)
Society for Cryobiology

Journals Refereed

Lab on a Chip; Chemical Science; Sensors and Actuators B: Chemical