

**The Faculty of Medicine of Harvard University  
Curriculum Vitae**

**Date Prepared:** September 25, 2023

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**Education:**

05/2011	B.S.	Mechanical & Aerospace Engineering	Cornell University, Ithaca, NY
09/2017	Ph.D.	Biomedical Engineering (Advisor: M. Selim Ünlü)	Boston University, Boston, MA

**Postdoctoral Training:**

09/17-07/18	Postdoctoral Fellow	Electrical & Computer Engineering (Advisor: M. Selim Ünlü)	Boston University, Boston, MA
07/18-01/23	Postdoctoral Fellow	Center for Engineering in Medicine & Surgery (Advisor: Mehmet Toner)	Massachusetts General Hospital Boston, MA

**Faculty Academic Appointments:**

01/2023-	Instructor in Surgery	Harvard Medical School, Boston, MA
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**Appointments at Hospitals:**

01/2023-	Research Staff	Massachusetts General Hospital, Boston, MA
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**Professional Societies:**

2019-	Society for Cryobiology	Member
2023-	Biomedical Engineering Society	Member

**Editorial Activities:**

- **Ad hoc Reviewer**

*Lab on a Chip*

*Chemical Science*

*Sensors and Actuators B: Chemical*

## **Report of Funded and Unfunded Projects**

### **Current**

- 2022-2026 Intracellular delivery of DNA-editing proteins by viscoelastic cell stretching  
NIH NIAID 1K99AI167063-01A1 – Pathway to Independence Award  
PI (\$550,000 total 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 total 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.

## **Report of Local Teaching and Training**

### **Research Supervisory and Training Responsibilities:**

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|-----------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 2015-2018 | Supervision and training of junior graduate students (about 2 per year)                                                | Boston University<br>Daily training & supervision for about 16 weeks.                                  |
| 2016-2018 | Supervision of undergraduate Senior Research Project teams and individual undergraduate research projects (2 per year) | Boston University<br>Daily training and supervision, weekly meetings 2 hours per week per team/student |
| 2020-     | Training and certification for flow cytometry and high-speed microscopy (About 5 fellows per year)                     | MGH<br>5-10 hours per fellow per year                                                                  |
| 2021-     | Training for microfluidics fabrication (About 2 fellows per year)                                                      | MGH<br>10-20 hours per fellow per year                                                                 |
| 2022-     | Mentor, CEMS Summer Academy (1 undergraduate/high school student yearly)                                               | MGH<br>16 hours per week for about 12 weeks                                                            |

### **Other Mentored Trainees and Faculty:**

- 2021-2023 Carlie Rein, laboratory technician, MGH  
*Mentoring role:* Supervisor. *Accomplishments:* First-author manuscript in *Scientific Reports*. Accepted to Columbia MS program in Biomedical Engineering starting 9/2023.

### **Local Invited Presentations:**

- ☒ No presentations below were sponsored by 3<sup>rd</sup> parties/outside entities
- ☐ Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.

- 2023 “High throughput intracellular delivery by viscoelastic mechanoporation”  
Harvard Department of Physics, Cambridge, MA (“Squishy Physics” Seminar Series)

## **Report of Regional, National and International Invited Teaching and Presentations**

- ☒ *No presentations below were sponsored by 3<sup>rd</sup> parties/outside entities*
- ☐ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

### **Regional**

- 2018            “Single-molecule microarrays with interferometric detection of plasmonic nanorod labels”  
Boston University, Boston, MA (BU Postdoctoral Association)
- 2018            “Digital DNA microarrays: Beating fluorescence with plasmonics”  
Boston University, Boston, MA (BU OSA/SPIE Student-organized conference)

## **Report of Technological and Other Scientific Innovations**

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|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Method and system for enhanced single particle reflectance imaging (2015-2018)                                    | As a graduate student in the Ünlü lab, I invented a technology for rapid optical detection of individual nanoparticles on a structured thin film substrate. This strategy enables multiplexed single molecule biosensing as well as single virus detection for ultrasensitive viral diagnostics.<br>US Patent App 2019/0162647 A1                                                                           |
| Disposable fluidic cartridge for interferometric reflectance imaging sensor (2015-2018)                           | As a graduate student in the Ünlü lab, I invented a disposable microfluidic biosensor chip for binding affinity studies, based on semiconductor materials and laminate adhesives.<br>US Patent App 2021/0069706 A1                                                                                                                                                                                          |
| Systems and methods for imaging microwell plate samples (2016-2018)                                               | As a graduate student in the Ünlü lab, I invented a scheme for imaging semiconductor biosensor chips in a microwell plate format, for high throughput and multiplexed screening of biomolecule affinity.<br>US Patent 10,585,042 B2                                                                                                                                                                         |
| Dynamic tracking of captured targets for enhanced digital biosensing (2016-2018)                                  | As a graduate student in the Ünlü lab, I invented a strategy for ultrasensitive single-molecule molecular diagnostics, which improves upon existing single-molecule detection schemes by also dynamically monitoring the duration of individual molecular binding events.<br>US Patent App 2019/0339268 A1                                                                                                  |
| Enzymatic assay to measure long-term adherence to pre exposure prophylaxis and antiretroviral therapy (2018-2021) | As a postdoc in the Toner lab and together with collaborators at the University of Washington, I invented a biochemical assay for antiretroviral drug activity based on targeted inhibition of viral reverse transcriptase. This assay is being developed further for near-patient testing of antiretroviral medication adherence to improve HIV treatment and prevention.<br>US Patent App 2022/0307066 A1 |

Viscoelastic mechanoporation systems and methods of use thereof (2020-)

As a postdoc in the Toner lab, I invented a transfection technology which enables the temporary mechanical disruption of the plasma membrane (so-called mechanoporation) of individual cells *ex vivo* by using microfluidic control of viscoelastic flow forces on the cell membrane.  
US Patent App 2022/012098

## **Report of Scholarship**

### **Peer-Reviewed Scholarship in print or other media:**

#### **Research Investigations**

Google Scholar profile: <https://scholar.google.com/citations?user=2QAce2gAAAAJ&hl=en>  
ORCID: 0000-0002-0327-5638  
(1–18)

1. Sevenler D, Buckley MR, Kim G, van der Meulen MCH, Cohen I, Bonassar LJ. Spatial periodicity in growth plate shear mechanical properties is disrupted by vitamin D deficiency. *J Biomech*. 2013 Jun 21;46(10):1597–603.
2. Sevenler D, Ünlü MS. Numerical techniques for high-throughput reflectance interference biosensing. *J Mod Opt*. 2015 Dec 17;0(0):1–6.
3. Scherr SM, Daaboul GG, Trueb J, Sevenler D, Fawcett H, Goldberg B, et al. Real-Time Capture and Visualization of Individual Viruses in Complex Media. *ACS Nano*. 2016 Feb 23;10(2):2827–33.
4. Ekiz-Kanik F, Sevenler DD, Ünlü NL, Chiari M, Ünlü MS. Surface chemistry and morphology in single particle optical imaging. *Nanophotonics*. 2017;6(4):713–30.
5. Sevenler D, Avci O, Ünlü MS. Quantitative interferometric reflectance imaging for the detection and measurement of biological nanoparticles. *Biomed Opt Express*. 2017 Jun 1;8(6):2976–89.
6. Trueb J, Avci O, Sevenler D, Connor JH, Ünlü MS. Robust Visualization and Discrimination of Nanoparticles by Interferometric Imaging. *IEEE J Sel Top Quantum Electron*. 2017 Mar;23(2):1–10.
7. Sevenler D, Daaboul GG, Ekiz Kanik F, Ünlü NL, Ünlü MS. Digital Microarrays: Single-Molecule Readout with Interferometric Detection of Plasmonic Nanorod Labels. *ACS Nano*. 2018 Jun 26;12(6):5880–7.
8. Sevenler D, Trueb J, Ünlü MS. Beating the reaction limits of biosensor sensitivity with dynamic tracking of single binding events. *Proc Natl Acad Sci*. 2019 Feb 18;201815329.
9. Drain P, Bardon A, Simoni J, Cressey T, Anderson P, Sevenler D, et al. Point-of-care and Near Real-time Testing for Antiretroviral Adherence Monitoring to HIV Treatment and Prevention. *Curr HIV/AIDS Rep*. 2020 Oct 1;17(5):487–98.

10. Jaskiewicz JJ, Sevenler D, Swei AA, Widmer G, Toner M, Tzipori S, et al. Cryopreservation of infectious *Cryptosporidium parvum* oocysts achieved through vitrification using high aspect ratio specimen containers. *Sci Rep*. 2020 Jul 16;10(1):11711.
11. Olanrewaju AO, Sullivan BP, Zhang J, Bender AT, Sevenler D, Lo TJ, et al. An enzymatic assay for rapid measurement of antiretroviral drug levels. *ACS Sens* [Internet]. 2020 Apr 6 [cited 2020 Apr 9]; Available from: <https://doi.org/10.1021/acssensors.9b02198>
12. Sevenler D, Bardon A, Fernandez Suarez M, Marshall L, Toner M, Drain P, et al. Immunoassay for HIV Drug Metabolites Tenofovir and Tenofovir Diphosphate. *ACS Infect Dis*. 2020 Jul 10;6(7):1635–42.
13. Olanrewaju AO, Sullivan B, Gim A, Sevenler D, Bender A, Drain P, et al. REVerSe TRanscriptase Chain Termination (RESTRICt) for Selective Measurement of Nucleotide Analogs Used in HIV Care and Prevention. 2021 Sep 20 [cited 2021 Oct 20]; Available from: <https://chemrxiv.org/engage/chemrxiv/article-details/614789914853d27d08aa7647>
14. Sevenler D, Bean H, Toner M, Sandlin RD. Slow-delivery and distributed exchange of cryoprotective agents with hydrogel beads. *Cryobiology* [Internet]. 2021 Sep 22 [cited 2021 Oct 4]; Available from: <https://www.sciencedirect.com/science/article/pii/S0011224021001528>
15. Sevenler D, Niu X, Dossantos S, Toner M, Cressey TR, Sandlin RD, et al. Point-of-care semi-quantitative test for adherence to tenofovir alafenamide or tenofovir disoproxil fumarate. *J Antimicrob Chemother*. 2022 Apr 1;77(4):996–9.
16. Ekiz Kanik F, Celebi I, Sevenler D, Tanriverdi K, Lortlar Ünlü N, Freedman JE, et al. Attomolar sensitivity microRNA detection using real-time digital microarrays. *Sci Rep*. 2022 Sep 28;12(1):16220.
17. Rein C, Toner M, Sevenler D. Rapid prototyping for high-pressure microfluidics. *Sci Rep*. 2023 Jan 22;13(1):1–9.
18. Jaskiewicz JJ, Dayao DAE, Girouard D, Sevenler D, Widmer G, Toner M, et al. Scalable cryopreservation of infectious *Cryptosporidium hominis* oocysts by vitrification. *PLOS Pathog*. 2023 Jun 8;19(6):e1011425.

#### **Non-peer reviewed scholarship in print or other media:**

#### **Reviews, chapters, and editorials**

1. Sevenler D, Ünlü NL, Ünlü MS. Nanoparticle Biosensing with Interferometric Reflectance Imaging. In: *Nanobiosensors and Nanobioanalyses*. Springer, Tokyo; 2015. p. 81–95.
2. Drain PK, Bardon AR, Simoni JM, Cressey TR, Anderson PA, Sevenler D, Olanrewaju AO, Gandhi M, Celum C. Point-of-care and near real-time testing for antiretroviral adherence monitoring to HIV treatment and prevention. Springer, US; 2020. P. 487-498.

### **Other non-peer reviewed scholarship**

1. Ahn S, Sevenler D, Monroe M, editors. Biosensors: Innovations in nanobiosensing and biophotonics at Boston University. Boston University, Boston MA; 2013.

### **Manuscripts submitted to preprint servers:**

1. Sevenler D, Toner M. 2023. High throughput intracellular delivery by viscoelastic mechanoporation. Arxiv <https://doi.org/10.1101/2023.04.24.538131>

### **Abstracts, poster presentations, and exhibits presented at professional meetings:**

- |      |                                                                                                                                                                                                                                                                       |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2011 | “Vitamin D Deficiency Disturbs the Shear Strain Profile of the Growth Plate”<br>Biomedical Engineering Society Annual Meeting, Hartford, CT (oral presentation)                                                                                                       |
| 2014 | “Enhanced interferometric detection of individual nanorods for multiplexed sensitive molecular assays”<br>Biomedical Engineering Society Annual Meeting, San Antonio, TX (poster presentation)                                                                        |
| 2017 | “Direct quantification of low-concentration protein and nucleic acid biomarkers with interferometric detection of nanoparticle labels”<br>IEEE Special Topics Conference on Healthcare Innovations and Point-of-Care Technologies, Bethesda, MD (poster presentation) |
| 2018 | “A digital microarray for transcriptional biomarkers of antibiotic resistance”<br>SPIE Photonics West BiOS, San Francisco, CA (oral presentation)                                                                                                                     |
| 2020 | “Programmable uptake and release of cryoprotective agents from semipermeable hydrogel beads”<br>Society of Cryobiology Annual Meeting (oral presentation, virtual)                                                                                                    |
| 2023 | “High throughput intracellular delivery by viscoelastic mechanoporation”<br>Gordon Research Conference on Advanced Biomanufacturing, Newry, ME (poster Presentation)                                                                                                  |
| 2023 | “High throughput intracellular delivery by viscoelastic mechanoporation”<br>Biomedical Engineering Society Annual Meeting, Seattle, WA (oral presentation, scheduled)                                                                                                 |