

**Samuel E. Root, Ph.D.**

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## RESEARCH INTERESTS

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My research is centered around the material science and engineering of functional macromolecular composites. My work encompasses synthesis, processing, and characterization, complemented by theory and computer simulations.

## RESEARCH EXPERIENCE

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- Present**      **Assistant Professor**, Macromolecular Science & Engineering, Case Western Reserve University
- 07-12/2024**   **Scientific Consultant**, [Thintronics Inc.](#) Leading advanced materials characterization efforts: Profilometry, electron microscopy, X-ray tomography, Raman spectroscopy, atomic force microscopy
- 2021-2024**    **Postdoctoral Scholar**, Department of Chemical Engineering, Stanford University  
Faculty Advisor: Zhenan Bao, Professor of Chemical Engineering, Chemistry, & Materials Science  
Faculty Collaborations: Jian Qin, Ruike Renee Zhao, Carla Pugh.  
Project: Investigation of electrical and mechanical self-healing in multilayered composites of immiscible dynamic polymers using modular synthesis, experimental characterization, and coarse-grained simulations.
- 2018–2021**   **Postdoctoral Fellow**, Department of Chemistry & Chemical Biology, Harvard University  
Faculty Advisor: George M. Whitesides, Woodford L. and Ann A. Flowers University Professor  
Faculty Collaborations: Conor Walsh, L. Mahadevan, Shervanthi Homer-Vanniasinkam  
Projects: Design of soft, adaptive systems for robotics and biomedical applications by leveraging the mechanical behavior of polymers. Physical-organic investigations of charge transport through self-assembled monolayers by combining modular synthesis and characterization with molecular simulations.

## EDUCATION

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- 2014–2018**   **Ph.D. in Chemical Engineering**, University of California, San Diego, CA  
Thesis: Mechanical Properties of Semiconducting Polymers  
Faculty Advisor: Darren J. Lipomi, Professor of Nanoengineering  
Faculty Collaborations: Gaurav Arya, Shirley Meng
- 2011– 2014**   **B.S. in Chemical Engineering**, University of Rochester, NY  
*Minor in applied mathematics, Highest Distinction in Chemical Engineering*  
Faculty Adviser: Alexander Shestapolav, Professor of Chemical Engineering  
External Advisor: Kenneth Marshall (Laboratory for Laser Energetics, Organic Optical Materials Group)

## FELLOWSHIPS & AWARDS

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### Fellowships

Achievement Reward for College Scientists (ARCS) Fellowship, 2017-18  
UC Presidents Dissertation Year Fellowship, 2017-18  
UC San Diego Powell Fellowship, 2014-15

### Awards

Corning Glass Age Runner-up Award (\$30 000 research gift, based on written proposal), 2017-18  
ACS *Chemistry of Materials* Lectureship & Paper of the Year Award, 2018  
Participant in “Future Faculty Workshop: Diverse Leaders for the Future”, summer 2023, Texas A&M  
Participant in “Rising Stars in Soft and Biological Matter”, Fall 2023, University of Chicago MRSEC

## SELECTED MEDIA COVERAGE

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- [NSF Discoveries: Layers of self-healing electronic skin realign autonomously when cut](#)
- [Chemical & Engineering News: Glowing dyes could store digital data at low cost](#)
- [Current Science Daily: Harvard team designs soft robotic mechanism modeled from biology](#)

## PUBLICATIONS

### Leading Author Journal Articles († indicates equal contribution) (Listed in Reverse Chronological Order)

- 1 Zhao, C.; † Park, J.; † **Root, S. E.**; † Bao, Z.; [Skin-inspired soft bioelectronic materials, devices, and systems](#). *Nature Reviews Bioengineering*, **2024**
- 2 Cooper, C.†; **Root, S. E.**†; Michalek, L.; Wu, S.; Lai, J.-C.; Khatib, M.; Oyakhire, S.; Zhao, R.; Qin, J.; Bao, Z.\*; [Autonomous alignment and self-healing in multilayer soft electronics using dynamic polymers with immiscible backbones](#). *Science*, **2023**
- 3 Li, Y.†; **Root, S. E.**†; Belding, L.; Park, J.; Yoon, H. J.; Huang, C.; Baghbanzadeh, M.; Whitesides, G. M.\*; [Charge Transport Measured Using the EGaIn Junction Through Self-Assembled Monolayers Immersed in Organic Solvents](#). *Journal of Physical Chemistry B*, **2023**
- 4 **Root, S. E.**†; Sanchez, V.†; Tracz, J.A.†; Preston, Whitesides, G. M.\*; [An Expanding Foam-Fabric Orthopedic Cast](#). *Advanced Materials Technologies*, **2022**
- 5 **Root, S. E.**; Preston, D. J.; Nemitz, M. P.; Belding, L.; Alcoran, R.; Fiefke, G.; Whitesides, G. M.\*; [Bio-inspired design of soft mechanisms using a toroidal hydrostat](#). *Cell Press Reports Physical Science*, **2021**, 2, 100572 **Citations: 6**
- 6 **Root, S. E.**†; Gao, R.†; Ge, S.; Whitesides, G. M.; [Estimating the Density of Thin Polymeric Films using Magnetic Levitation](#). *ACS Nano*, **2021**
- 7 Li, Y.†; **Root, S. E.**†; Baghbanzadeh, M.; Campbell V. E.; Rothmund, P. Cafferty, B. J.; Whitesides, G. M.\*; [Characterizing Chelation at Surfaces by Charge Tunneling](#). *Journal of the American Chemical Society* **2021**
- 8 Belding, L.\*; **Root, S. E.**\*; Li, Y.; Park, J.; Rojas, E.; Pieters, P.; Whitesides, G. M.\*; Conformation, and Charge Tunneling Through Molecules in Self-Assembled Monolayers. *Journal of the American Chemical Society* **2021**
- 9 Runser, R.†; **Root, S. E.**†; Ober, D. E.; Choudhary, K.; Chen, A. X.; Dhong, C.; Urbina, A. D.; Lipomi, D.J.\*; [Interfacial Drawing: Roll-to-Roll Coating of Semiconducting Polymer and Barrier Films on Plastic Foils and Textiles](#) *Chemistry of Materials* **2019**
- 10 **Root, S. E.**; Carpenter, C.W.; Kayser, L. V.; Rodriguez, D.; Davies, D. M.; Wang, S.; Tan, S. T. M.; Meng, Y. S.; Lipomi, D. J.\*; [Ionotactile Stimulation: Ionic Gels for Haptic Human-Machine Interfaces](#) *ACS Omega* **2018**, 662-668
- 11 Alkhadra, M. A.†; **Root, S. E.**†; Hilby, K. M.; Rodriguez, D.; Sugiyama, F.; Lipomi, D. J.\*; [Quantifying the Fracture Behavior of Brittle and Ductile Thin Films of Semiconducting Polymers](#), *Chemistry of Materials* **2017**
- 12 **Root, S. E.**†; Alkhadra, M. A.†; Rodriguez, D.; Printz, A. D.; Lipomi, D. J.\*; [Measuring the Glass Transition Temperature of Conjugated Polymer Films with Ultraviolet-Visible Spectroscopy](#). *Chemistry of Materials* **2017** (Lectureship & Best Paper Award)
- 13 **Root, S. E.**; Savagatrup, S.; Printz, A. D.; Rodriguez, D.; Lipomi, D. J.\*; [Mechanical Properties of Organic Semiconductors for Stretchable, Highly Flexible, and Mechanically Robust Electronics](#). *Chemical Reviews* **2017** (selected as ACS Editors' Choice)
- 14 **Root, S. E.**; Jackson, N. E.; Savagatrup, S.; Arya, G.; Lipomi, D. J.\*; [Modelling the Morphology and Mechanical Behaviour of Low-Bandgap Conjugated Polymers and Bulk Heterojunction Films](#). *Energy & Environmental Science* **2017** (featured as a hot article)
- 15 **Root, S. E.**; Savagatrup, S.; Pais, C. J.; Arya, G.; Lipomi, D. J.\*; [Predicting the Mechanical Properties of Organic Semiconductors Using Coarse-Grained Molecular Dynamics Simulations](#). *Macromolecules* **2016**

### Contributing Author Journal Articles (Listed in Reverse Chronological Order)

- 16 A. Berman†; K. Hsiao†; **S. E. Root**; H. Choi; D. Ilyn; C. Xu; E. Stein; M. Cutkosky† J. M. Desimone\*; Z. Bao\* [Additively manufactured micro-lattice dielectrics for multiaxial capacitive sensors](#), *Science Advances*, **2024**
- 17 E. Kim; J.-C. Lai; L. Michalek, W. Wang, C. Xu, H. Lyu, W. Yu, H. Park, Y. Tomo, **S. E. Root**; B. Lee; J. Park; S. Wei; C. Zhao; Z. Bao\* [A Transparent, Patternable, and Stretchable Conducting Polymer Solid Electrode for Dielectric Elastomer Actuators](#), *Advanced Functional Materials*, **2024**
- 18 Kim, K. K.†; Kim, M.†; Pyun, K.; Kim, J.; Min, J.; Koh, S.; **Root, S. E.**; Kim, J.; Nguyen, B. N. T.; Nishio, Y.; Han, S.; Choi, J.; Kim, C.Y.; Tok, J. B.-H.; Jo, S.; Ko, S. H.\*; Bao, Z.\*; [A Substrate-Less Nanomesh Receptor with Meta-Learning for Rapid Hand Task Recognition](#), *Nature Electronics*, **2023**
- 19 Peña-Alcántara, A.I Nikzad, S.; Prine, N.; Wang, Y.; Michalek, L.; Gong, H.; Ponte, E.; Schneider, S.; Wu, Y.; **Root, S.E.**; Tok, J.B.-H.; Gu, X.\*; Bao, Z.\*; [Effect of Molecular Weight on the Morphology of a Polymer Semiconductor](#)

[Blended with a Thermoplastic Elastomer](#), *Advanced Electronic Materials*, **2023**

- 20 Gao, R.<sup>†</sup>; Kodaimati, M. O.<sup>†</sup>; Handy, K.; **Root, S. E.**; Whitesides, G. M.\*; [Generating Oscillatory Behavior by Applying a Magnetic Field During the Electrocatalytic Oxidation of Glycerol](#) *Journal of Physical Chemistry C*, **2022**
- 21 Decker, C. J.<sup>†</sup>; Jiang, H. J.<sup>†</sup>; Nemitz, M. P.; **Root, S. E.**; Rajappan, A.; Alvarez, J. T.; Tracz, J.; Wille, L.; Preston, D.J.; Whitesides, G. M.\*; [Programmable Soft Valves for Digital and Analog Control](#), *Proceedings of the National Academy of Sciences*, **2022**
- 22 Tracz, J. A.; Wille, L.; Pathiraja, D.; Kendre, S. V.; Pfisterer, R.; Turett, E.; Abrahamsson, C. K.; **Root, S. E.**; Lee, W. K.; Preston, D. J.; Jiang, H. J.; Whitesides, G. M.\*; Nemitz, M. P.\*; [Tube-Balloon Logic for the Exploration of Fluidic Control Elements](#) *IEEE Robotics and Automation Letters*,
- 23 Park, J.; Kodaimati, M. A.; Belding, L.; **Root, S. E.**; Schatz, G.; Whitesides, G. M.\*; [Controlled Hysteresis of Conductance in Molecular Tunneling Junctions](#), *ACS Nano*, **2022**
- 24 Kodaimati, M. A.<sup>†</sup>; Gao, R.<sup>†</sup>; **Root, S. E.**; Whitesides, G. M.\*; [Magnetic Fields Enhance Mass Transport During Electrocatalytic Reduction of CO<sub>2</sub>](#), *Chem Catalysis*, **2022**
- 25 Nagarkar, A.; **Root, S. E.**; Fink, M. J.; Ten, A. S.; Cafferty, B. J.; Richardson, D. S.; Mrksich, M.; Whitesides, G. M.\*; [Storing and Reading Information in Mixtures of Fluorescent Molecules](#). *ACS Central Science* **2021**
- 26 Park, J.; Belding, L.; Li, Y.; Mousavi, M.; **Root, S. E.**; Yoon, H. J.; Whitesides, G. M.\*; Rectification in Molecular Tunneling Junctions based on Alkanethiolates with Bipyridine-Metal Complexes, *Journal of The American Chemical Society*, **2021**
- 27 Carpenter, C.W.; Malinao, M.G.; Rafeedi, T.A.; Rodriguez, D.; Tan, S.T.M.; Root, N.B.; Skelil, K.; Ramirez, J.; Polat, B.; **Root, S.E.**; Ramachandran, V.S.; Lipomi, D.J.\*; [Electropneumotactile Stimulation: Multimodal Haptic Actuators Enabled by a Stretchable Conductive Polymer on Inflatable Pockets](#) *Advanced Materials Technologies*, **2020**
- 28 Sugiyama, F.; Kleinschmidt, A. T.; Kayser, L.V.; Rodriguez, D.; Fin, M. F.; Alkhadra, M. A.; Wan, J. M. H.; Chiang, A. S. C.; Ramirez, J.; **Root, S. E.**; Lipomi, D. J.\*; [Effects of Flexibility and Branching of Side Chains on the Mechanical Properties of Low-Bandgap Copolymers](#) *Polymer Chemistry*, **2018**
- 29 Sugiyama, F.; Kleinschmidt, Kayser, L.V.; Alkhadra, M. A.; Wan, J. M. H.; Chiang, A. S. C.; Rodriguez, D.; **Root, S. E.**; Lipomi, D. J.\*; [Stretchable and Degradable Semiconducting Block Copolymers](#) *Macromolecules*, **2018**
- 30 Rodriguez, D.; Kohl, G.; Morel, P.; Burrows, K.; Favaro, G.; **Root, S. E.**; Ramirez, J.; Alkhadra, M.A.; Carpenter, C. W.; Fei, Z.; Boufflet, P.; Heeney, M.; Lipomi, D. J.\*; [Measurement of Cohesion and Adhesion of Semiconducting Polymers by Scratch Testing: Effect of Side-Chain Length and Degree of Polymerization](#) *Macroletters*, **2018**
- 31 Kleinschmidt, A. T.; **Root, S. E.**; Lipomi, D. J.\*; [Poly \(3-hexylthiophene\) \(P3HT\): Fruit Fly or Outlier in Organic Solar Cell Research?](#) *Journal of Materials Chemistry A* **2017**
- 32 Marin, B. C.; **Root, S. E.**; Urbina, A. D.; Alkile, E.; Miller, R.; Zaretski, A. V.; Lipomi, D. J.\*; [Graphene-Metal Composites with Near-Zero Temperature Coefficient of Resistance](#) *ACS Omega* **2017**, 2, 626-630.
- 33 Marin, B. C.; Ramirez, J.; **Root, S. E.**, Aklile, E.; Lipomi, D. J.\*; [Metallic Nanoislands on Graphene: A Metamaterial for Chemical, Mechanical, Optical, and Biological Applications](#). *Nanoscale Horizons* **2017**, 2, 311-318.
- 34 O'Connor, T. F.; Fach, M. E.; Miller, R.; **Root, S. E.**; Mercier, P. P.; Lipomi, D. J.\*; [The Language of Glove: Wireless gesture decoder with low-power and stretchable hybrid electronics](#). *PloS one* **2017**, 12, 1-12.
- 35 Rodriguez, D.<sup>†</sup>; Kim, J.H.<sup>†</sup>; **Root, S. E.**; Fei, Z.; Boufflet, P.; Heeney, M.; Kim, T. S.\*; Lipomi, D. J.\*; [Comparison of Methods for Determining the Mechanical Properties of Semiconducting Polymer Films for Stretchable Electronics](#) *Applied Materials & Interfaces* **2017**, 9, 8855-8862.
- 36 Zaretski, A. V.; **Root, S. E.**; Savchenko, A.; Molokanova, E.; Printz, A. D.; Jibril, L.; Arya, G.; Mercola, M.; Lipomi, D. J.\*; [Metallic Nanoislands on Graphene as Highly Sensitive Transducers of Mechanical, Biological, and Optical Signals](#). *Nano Letters* **2016**, 16, 1375-1380
- 37 Savagatrup, S.; Printz, A. D.; O'Connor, T. F.; Zaretski, A. V.; Rodriguez, D.; Sawyer, E. J.; Rajan, K. M.; Acosta, R. I.; **Root, S. E.**; Lipomi, D. J.\*; [Mechanical Degradation and Stability of Organic Solar Cells: Molecular and Microstructural Determinants](#). *Energy & Environmental Science* **2015**, 8, 55-80.

Khatib, M.<sup>†</sup>; Zhao, E. R.<sup>†</sup>; Wei, S.<sup>†</sup>; Abramson, A.; Bishop, E. B.; Chen, C.-H.; Thomas, A.-L.; Xu, C.; Park, J.; Lee, Y.; Hamnett, R.; Yu, W.; **Root, S. E.**; Yuan, L.; Chakhtoura, D.; Kim, K. K.; Zhong, D.; Nishio, Y.; Zhao, C.; Wu, C.; Jiang, Y.; Zhang, A.; Li, J.; Wang, W.; Salimi-Jazi, F.; Rafeeqi, T. A.; Hemed, N. M.; Tok, J.B.H.; Chen, X.; Kaltschmidt, J. A.; Dunn, J.; Bao, Z. [Spiral NeuroString: High-Density Soft Bioelectronic Fibers for Multimodal Sensing and Stimulation](#), *BioRxiv*, 2023.10.02.560482 DOI: <https://doi.org/10.1101/2023.10.02.560482>

**Root, S.E.;** Choi, H.; Wu, C.; Sun, E.; Ngaruka, G.; Park, H.; Cooper, C. B.; Ramos-Figueroa, A. L.; Berman, A.; Kim, K. K.; Khatib, M.; Sanchez, V.; Cutkosky, M.; Pugh, C.; Bao, Z.; A Damage-Perceptive, Multilayer Self-Healing Electronic Skin, In Preparation

### Textbook Chapter

- 1 Alkhadra, M. A.; Kleinschmidt, A. T.; **Root, S. E.**; Rodriquez, D.; Printz, A. D.; Savagatrup, S.; Lipomi, D. J. Mechanical Properties of Semiconducting Polymers, *Conjugated Polymers: Properties, Processing, and Applications* 2019 CRC Press

### Patents

- 1 **Root, S.E.;** Fazzini, J.A.; Sanchez, V.; Preston, D.J.; Whitesides, G.M., “Expanding Foam-Fabric Orthopedic Limb Stabilization Device,” U.S. Provisional Patent Application No: 62/923,938, filed October 21, 2019. PCT Application, filed October 21, 2020.
- 2 Sakamoto, J.; Ten, A.; Kodaimati, M. S.; Jiang, H. J.; Nagarkar, A.; **Root, S. E.**; Whitesides, G. M., “Polyphosphate Materials” U.S. Provisional Patent Application No. 63/248691; WH Ref. No.: 42697.579US1
- 3 Cooper, C. B.; **Root, S. E.**; Bao, Z.; “Multi-layer self-healing apparatuses and methods” U.S. Provisional Patent Application No. 63/440,656, January 23, 2023

### PRESENTATIONS

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#### Invited Talks

1. UC Santa Barbara, Department of Material Science, March 22, 2018.
2. American Chemical Society Summer Meeting, Boston Ma., August 19, 2018
3. University of Rochester, Department of Chemical Engineering, October 7<sup>th</sup>, 2020 (virtual)
4. Technion-Israel Institute of Technology, Department of Chemical Engineering, October 20<sup>th</sup>, 2020 (virtual)
5. University of Kentucky, Department of Chemical & Materials Engineering, January 11<sup>th</sup>, 2023
6. Stevens Institute of Technology, Department of Chemical Engineering and Materials Science, February 10<sup>th</sup>, 2023
7. Tufts University, Department of Chemical & Biological Engineering, March 6<sup>th</sup>, 2023
8. UC San Diego, Department of NanoEngineering, August 8<sup>th</sup>, 2023
9. Stanford Polymer Collective (student selected), Stanford University, October 6<sup>th</sup>, 2023
10. Rising Stars in Soft and Biological Matter Symposium (University of Chicago MRSEC), October 12<sup>th</sup>, 2023
11. eWear Seminar, Stanford University, October 23<sup>rd</sup>, 2023
12. Florida State University, Department Chemical and Biomedical Engineering, January 3<sup>rd</sup>, 2024
13. Georgia Institute of Technology, Department of Chemical and Biomolecular Engineering, January 8<sup>th</sup>, 2024
14. University of Wisconsin, Madison, Department of Mechanical Engineering, January 22<sup>nd</sup>, 2024
15. Auburn University, Department of Chemical Engineering, February 5<sup>th</sup>, 2024
16. University of New Mexico, Department of Chemical & Biological Engineering, February 12<sup>th</sup>, 2024
17. Clemson University, Department of Chemical Engineering and Biomolecular Engineering, February 15<sup>th</sup>, 2024
18. Case Western Reserve University, Department of Macromolecular Science and Engineering, February 27<sup>th</sup>, 2024
19. University of Massachusetts, Amherst, Department of Chemical Engineering, March 11<sup>th</sup>, 2024
20. University of Akron, Department of Polymer Science and Polymer Engineering, March 14<sup>th</sup>, 2024
21. Lawrence Livermore National Laboratory, Center of Applied Science and Polymer Research, November 13<sup>th</sup>, 2024

#### Conference Talks

1. United States National Congress on Computational Mechanics, San Diego, CA, July 26-30, 2015
2. International Conference on Advanced Polymeric Materials, Jeju, Korea, October 4-7, 2016
3. Fall Meeting of the Materials Research Society, Boston, Massachusetts, December 2-5, 2016
4. Pan-American Polymer Science Conference, Guarujá, Sao Paulo State, Brazil, March 22-25, 2017
5. Fall Meeting of the Materials Research Society, Boston, Massachusetts, December 2-5, 2017
6. American Institute of Chemical Engineering (AIChE), November 10<sup>th</sup>-15<sup>th</sup>, 2019
7. (Virtual) American Physical Society March Meeting 2020
8. (Virtual) American Institute of Chemical Engineering Annual Meeting, November 16-20<sup>th</sup>, 2020

9. Fall meeting of the Materials Research Society, Boston, Massachusetts, December 2023
10. American Institute of Chemical Engineering Annual Meeting, San Diego, California, October 2024

## PROFESSIONAL SERVICE

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Peer reviewer for *ACS Macromolecules*, *ACS Chemistry of Materials*, *Frontiers in Chemistry*  
Member of the American Institute of Chemical Engineers and the Materials Research Society

## EXPERIENCE WITH TEACHING & MENTORSHIP

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### Teaching Assistant

Responsibilities included developing new class materials and exam questions; leading class discussions; grading assignments and exams; and meeting with students individually.

#### Graduate Level

- Applied Boundary Value Problems and Fourier Series Analysis (Fall 2013)  
University of Rochester, ~100 students.
- Intermolecular & Surface Forces (Fall 2015 & 16)  
University of California, San Diego, ~50 students.

#### Undergraduate Level

- Polymeric Materials (Winter 2016 & 17)  
University of California, San Diego, ~100 students.
- Statistical Thermodynamics (Spring 2020)  
Harvard University, ~30 students.

### Guest lecturer

Intermolecular & Surface Forces: Computer Simulations (Winter 2017) (video recording on YouTube)  
Polymeric Materials: Computer Simulations (Spring 2016 & 17)  
Statistical Thermodynamics (Spring 2020)

### Mentees at Stanford University (9/2021–present)

- Alexandra L. Figueroa Ramos, graduate student in chemical engineering, (09/22–present)  
*Project title:* Selective self-healing between dynamic polymers with orthogonal dynamic bonds
- Arielle Berman, graduate student in chemical engineering (09/22–present)  
*Project title:* 3D printed capacitive sensors of pressure and shear stress.
- Gradie Ngaruka, undergraduate student in chemical engineering, '24 (06/22 – present)  
*Project title:* A self-healing, damage-sensing electronic skin for surgical simulation
- Eric Sun, high school summer intern (06/23-08/23)  
*Project title:* A self-healing, damage-sensing electronic skin for surgical simulation
- Ian Coates, rotational graduate student in chemical engineering (01/22-05/22)  
*Project title:* Development of resistive pressure sensors based on self-healing composites

### Mentees at Harvard University (4/2018 – 8/2021)

- Jovanna A. Tracz, Postbaccalaureate pre-med student (1/19–6/20)  
*Project title:* An expanding foam-fabric orthopedic cast
  - Awarded SWE WeLocal San Diego Best Poster Award 2020
  - Currently: medical student at Eastern Virginia Medical School
- Julie Ortiz, undergraduate student in mechanical engineering (9/18–6/19)  
*Project title:* An expanding foam-fabric orthopedic cast (Senior design project)
  - Currently: robotics and coding instructor at Happy Code Club
- Hunter Wallace, undergraduate student in mechanical engineering (9/19–6/20)  
*Project title:* Gripping, catching, and conveying with a soft toroidal hydrostat
  - Currently: Senior System Engineer at Symbotic
- Renz Marion Alcoran, aerospace engineering REU student (06/18-08/18)  
*Project title:* Gripping, catching, and conveying with a soft toroidal hydrostat



- Gideon Feifke, mechanical engineering REU student (06/18-08/18)  
*Project title:* Gripping, catching, and conveying with a soft toroidal hydrostat
  - Currently: Engineer at Markforged

### Mentees at UC San Diego (9/2014 – 2/2018)

- Rory Runser, first year graduate student in chemical engineering (09/17-02/18)  
*Project title:* Interfacial drawing of polymer thin films
  - Currently: Materials Engineer at GAF
- Kristan Hilby, undergraduate nanoengineering student (06/17-02/18)  
*Project title:* Fracture behavior in thin films of semiconducting polymers
  - Currently: PhD candidate at Massachusetts Institute of Technology
- Mohammad Alkhadra, undergraduate chemical engineering student (06/16-02/18)  
*Project title:* Thermomechanical behavior of thin films of semiconducting polymers
  - *ACS Chemistry of Materials* Lectureship & Paper of the Year, 2018
  - Currently: Co-founder and CEO at Lithios.
- Armando Urbina, undergraduate chemical engineering student (06/16-06/17)  
*Project title:* Graphene-metal composites for resistive strain sensors
  - Currently: Graduate student at University of Southern California
- C.J. Pais, undergraduate student in computer science (06/15-06/16)  
*Project title:* Coarse-grained molecular dynamics simulations of semiconducting polymers
  - Currently: Software engineer at Qualcomm.

### Educational Outreach

Laboratory tours at UC San Diego for K-12 outreach, ~5 per year, 2014-18

Weekly science lessons with a single 3<sup>rd</sup> grade class at Dingeman Elementary School (Fall 2017)

Weekly science lessons with various 5<sup>th</sup> grade classes from Boston Public Schools (April 2019)

Engineering Immersion Program, monthly workshops with high school students, (Spring 2022)

Perry Outreach Program, introducing high school women to careers in orthopedic surgery & engineering (Spring 2022)

### GRANTS

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#### As Principal Investigator: (Total Funding Secured: \$ 55,000)

1. National Science Foundation, ACCESS Discover supercomputer allocation (estimated value ~\$10,000, 10/05/22 - 10/04/23, **PI: Samuel E. Root**, Co-PI: Zhenan Bao), “Coarse-grained molecular dynamics simulations of interfaces of dynamic polymers and composites”
2. National Science Foundation, XSEDE Research Allocation (estimated value ~\$15,000, 1/1/19-1/1/20, **PI: Samuel E. Root**, Co-PI: George M. Whitesides), “Molecular Dynamics Simulations of Self-Assembled Monolayers for Molecular Electronics”
3. Corning inc., Glass Age Fellowship Runner Up (**PI: Samuel E. Root**, \$30,000, 2017-18), “Modeling of Mechanically Robust Molecular Semiconductor Glasses for Flexible Electronics.
4. Thrasher Research Fund (Pediatric Healthcare), Early Career Award (**PI: Samuel E. Root**, rejected in final round, best 20 out of 140 proposals), “A Foam-Fabric Orthopedic Cast for Fractures of the Wrist in Pediatric Populations”
5. National Institute of Health, F32 Postdoctoral Fellowship (**Fellow: Samuel E. Root**, score 33, percentile 43%, not funded, 2022), “Reusable, Multisensory Surgical Simulation Models Based on Self-healing Composites of Dynamic Polymers with Conductive Nanomaterials”

#### As a Contributing Author (Total Funding Secured: \$ 1,460,000)

6. National Science Foundation, Division of Materials Research (*currently pending*, PI: Zhenan Bao). “Periodic Dynamic Polymers with Strain-Induced Supramolecular Structures for One-Way and Two-Way Shape-Memory Actuators”—contributed 4 out of 20 pages including one task, and the broader impacts section.
7. National Science Foundation, Division of Chemistry (\$800,000, 9/1/22–8/31/26, PI: George M. Whitesides), “Quantum Charge Tunneling through Self-Assembled Monolayers”—led writing of entire proposal with feedback from adviser.
8. Air Force Office of Scientific Research (\$450 000, 5/1/16–4/30/19, PI: Darren Lipomi, co-PIs: Gaurav Arya and Shyue Ping Ong), “High-performance semiconducting elastomers”—provided the core idea, a figure, and approximately 1.5

pages of text for one of three sub-projects.

9. National Science Foundation, XSEDE Research Allocation (\$60,872.98, 10/1/15-10/1/16, PI: Darren Lipomi Co-PI: Gaurav Arya), "Computational Design of Nanostructured Materials"—provided the core idea, wrote the proposal.
10. National Science Foundation, XSEDE Research Allocation (\$50,226.25, 10/1/16-10/1/17, PI: Darren Lipomi Co-PI: Gaurav Arya) "Computational Design of Nanostructured Materials"—provided the core idea, wrote the proposal.
11. Hellman Fellowship (\$46,000, 6/1/15–5/31/16, PI: Darren Lipomi), "Modeling the mechanical properties of organic semiconductors for flexible, printed devices"—made significant intellectual contributions, provided text and one figure.

## PROFESSIONAL REFERENCES

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### 1. Professor Darren J. Lipomi

*Professional Relationship:* PhD Adviser

Department of NanoEngineering

University of California, San Diego

Cell phone number: 1 (617) 797-9155

[dlipomi@eng.ucsd.edu](mailto:dlipomi@eng.ucsd.edu)

### 2. Professor George M. Whitesides

*Professional Relationship:* Postdoctoral Adviser

Department of Chemistry and Chemical Biology

Harvard University

[gmwoffice@gmwgroup.harvard.edu](mailto:gmwoffice@gmwgroup.harvard.edu)

### 3. Professor Zhenan Bao

*Professional Relationship:* Postdoctoral Adviser

Department of Chemical Engineering

Stanford University

1 (650) 723 2419

[zbao@stanford.edu](mailto:zbao@stanford.edu)

### 4. Professor Gaurav Arya

*Professional Relationship:* Computational Research Adviser/Collaborator

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