

## THOMAS R. GABORSKI

Professor of Biomedical Engineering  
Rochester Institute of Technology  
Rochester, NY 14623

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**Tom Gaborski** is an entrepreneurial bioengineering faculty member with expertise in materials engineering, biological separations, and cellular barrier models including the biophysical study of cell-substrate interactions.

As the director of the NanoBio Materials Laboratory at RIT, he leads a team studying and developing nanomembranes for tissue-on-a-chip and biological separations including extracellular vesicle purification and wearable hemodialysis. His laboratory has been funded by four institutes at the National Institutes of Health as well as the National Science Foundation, New York State, and multiple industry partners. He is also the Director of the Biomedical and Chemical Engineering Ph.D. program at RIT. He joined RIT in the spring of 2012 as a founding member of the Biomedical Engineering Department and the first permanent external hire. Before returning to academia, Tom was the co-founder and president of SiMPore, an early-stage nanomaterials company, where he helped raise two rounds of investment, was awarded three NIH grants as principal investigator and brought several products to market.

## PROFESSIONAL EXPERIENCE

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|--------------------------------------------------------------------|--------------|
| <b>Professor, Biomedical Engineering</b>                           | 2022-Present |
| <b>Director, Biomedical and Chemical Engineering Ph.D. Program</b> | 2020-Present |
| <b>Rochester Institute of Technology, Rochester, NY</b>            |              |
| <br>                                                               |              |
| <b>Associate Professor, Biomedical Engineering</b>                 | 2017-2022    |
| <b>Rochester Institute of Technology, Rochester, NY</b>            |              |
| <br>                                                               |              |
| <b>Assistant Professor, Biomedical Engineering</b>                 | 2012-2017    |
| <b>Rochester Institute of Technology, Rochester, NY</b>            |              |
| <br>                                                               |              |
| <b>President</b>                                                   | 2009-2012    |
| <b>SiMPore Inc., West Henrietta, NY</b>                            |              |
| <br>                                                               |              |
| <b>Vice President of Life Sciences</b>                             | 2008-2009    |
| <b>SiMPore Inc., West Henrietta, NY</b>                            |              |
| <br>                                                               |              |
| <b>Co-Founder &amp; Board Member</b>                               | 2007-present |
| <b>SiMPore Inc., West Henrietta, NY</b>                            |              |

## EDUCATION

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|                                                                                                        |      |
|--------------------------------------------------------------------------------------------------------|------|
| University of Rochester, Rochester, NY                                                                 |      |
| <b>Ph.D. in Biomedical Engineering</b>                                                                 | 2008 |
| Dissertation: <i>Quantitative methods for understanding physical mechanisms of neutrophil adhesion</i> |      |
| <br>                                                                                                   |      |
| University of Rochester, Rochester, NY                                                                 |      |
| <b>M.S. in Biomedical Engineering</b>                                                                  | 2004 |
| <br>                                                                                                   |      |
| Cornell University, Ithaca, NY                                                                         |      |
| <b>B.S. in Biological and Environmental Engineering</b>                                                | 2002 |

## AWARDS AND HONORS

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|----------------------------------------------------------------------|------|
| RIT Million Dollar PI Award                                          | 2019 |
| Featured Faculty - RIT's Faculty Scholarship Report                  | 2016 |
| Young Innovator Award in Cellular and Molecular Bioengineering, BMES | 2014 |
| One of 10 Faculty to Watch – RIT Athenaeum                           | 2014 |
| Kirschstein Individual Predoctoral Fellowship (F31), NIH NIBIB       | 2005 |
| Graduate Teaching Award, University of Rochester                     | 2007 |
| Sproull Presidential Graduate Fellowship, University of Rochester    | 2002 |
| Undergraduate Teaching Award, Cornell University                     | 2002 |

**TEACHING EXPERIENCE (11 DIFFERENT COURSES: 6 NEW COURSES DEVELOPED, 3 REDESIGNED)**

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**Interdisciplinary Research Methods BMECHE/ENGR 701 (RIT): 2022**

This course emphasizes collaboration in modern research environment and consists of five modules. Students are introduced to the concepts of inter-disciplinary and trans-disciplinary research conducted from both a scientific and an engineering perspective. Required course for all first-year Ph.D. students in the Biomedical and Chemical Engineering Ph.D. program.

**Graduate Research Practicum BIME 697 (RIT): 2022**

This course gives students supervised practical training within academic research laboratories prior to conducting their own dissertation research. Students will identify a laboratory or laboratories to conduct research. With the principal investigator of the research laboratory, students will complete a brief critical literature review in the sub-field of that laboratory. Students will be trained on experimental or computational methods specific to that laboratory and learn relevant applied data analysis techniques. As the Ph.D. Director, I serve as the lead and coordinator of our rotation program.

**Graduate Research Seminar BMECHE/ENGR 795 (RIT): 2022**

Weekly internal and external seminar series for all Biomedical and Chemical Engineering Graduate Students (enrollment 11).

**Graduate Literature Review BIME 749 (RIT): 2022**

This course introduces students to the methods involved in conducting a review of existing research. Students will also review current journal articles within a specific research domain identified by the course instructor. The course will allow flexibility for students to select and critically review articles that align with their research interests within this domain. Elective graduate course (enrollment 11).

**Medical Device Design BIME407 (RIT): 2018, 2019, 2020\*, 2021\*, 2022**

Renamed and redesigned the curriculum to implement the team project-based Biodesign process. Required core BME course plus elective for other engineering majors (enrollment 55-65)  
\*HyFlex simultaneous in-person and on-line 2020 and 2021

**Engineering Cell-Substrate Interactions BIME770 (RIT): 2019**

Designed, developed and delivered. Lecture and Lab.  
Elective graduate course (enrollment 7)

**Tissue Engineering BIME570/670 (RIT): 2014, 2015, 2016, 2018**

Designed, developed and delivered four times.  
Elective undergraduate and graduate course (enrollment 15)

**Introduction to Biomaterials BIME370 (RIT): 2013, 2014, 2015, 2016, 2017, 2018**

Designed, developed and delivered six times.  
Required core BME course (enrollment 55-60)

**Systems Physiology II BIME 411 (RIT): 2012, 2015**

Designed, developed and delivered. Co-taught with Daniel Phillips.  
Required core BME course (enrollment 50)

**Musculoskeletal Biomechanics BIME200 (RIT): 2012**

Redesigned course content and refined laboratory exercises. Lecture and Lab.  
Required core BME course (enrollment 45)

**Introduction to Programming for Biomechanics BME201L (University of Rochester): 2005, 2006**

Required core BME course covering programming fundamentals using MATLAB (enrollment 45)

## JOURNAL PUBLICATIONS

50. Gholizadeh S, Allahyari Z, Carter RN, Delgadillo LF, Marchi N and **Gaborski TR**. Effects of Oxygen Plasma Treatment on Parylene C and Parylene N Membrane Biocompatibility for Tissue Barrier Models. bioRxiv preprint. <https://doi.org/10.1101/2022.06.09.495451>
49. Poskus MD, **Gaborski TR** and Day SW. Computational Modeling of Blood Damage and Mass Transport in A Membrane-based Microfluidic Device. bioRxiv preprint. doi.org/10.1101/2020.06.15.152686
48. Ramirez MM, Soule CW, Delgadillo LF and **Gaborski TR**. Nanopatterned thermoresponsive functionalization of substrates via nanosphere lithography. bioRxiv preprint. doi.org/10.1101/796268.
47. Mansouri MM, Ahmed A, Ahmad D, McCloskey MC, Joshi IM, **Gaborski TR**, Waugh RE, McGrath JL, Day SW and Abhyankar VV. The Modular  $\mu$ SiM Reconfigured: Integration of Microfluidic Capabilities to Study in vitro Barrier Tissue Models under Flow. *Advanced Healthcare Materials*. 2022. <https://doi.org/10.1002/adhm.202200802>
46. Michel LV and **Gaborski TR**. Outer Membrane Vesicles as Molecular Biomarkers for Gram-negative Sepsis: Taking Advantage of Nature's Perfect Packages. *Journal of Biological Chemistry*. 2022. Accepted.
45. Ahmed A, Joshi IM, Mansouri MM, Byerley AM, Day SW, **Gaborski TR** and Abhyankar VV. Local Extensional Flows Induce Long-Range Fiber Alignment in 3D Collagen Hydrogels. *Biofabrication*. 2022. 14(3): 035019.
44. Allahyari Z and **Gaborski TR**. Engineering Cell-Substrate Interactions on Porous Membranes for Microphysiological Systems. *Lab on a Chip*. 2022. 22: 2080-2089.
43. Allahyari Z, Casillo SM, Perry SP, Gholizadeh S and **Gaborski TR**. Disrupted Surfaces of Porous Membranes Reduce Nuclear YAP Localization and Enhance Adipogenesis through Morphological Changes. *ACS Biomaterials Science & Engineering*. 2022. 8(5): 1791-1798.
42. Lucas K, Dehghani M, Khire T, Flax JD, **Gaborski TR** and McGrath JL. A Predictive Model of Nanoparticle Capture on Ultrathin Nanoporous Membranes. *Journal of Membrane Science*. 2021. 633: 119357.
41. Ahmed A, Joshi IM, Mansouri MM, **Gaborski TR** and Abhyankar VV. Engineering Fiber Anisotropy within Natural Collagen Hydrogels. *American Journal of Physiology-Cell Physiology*. 2021. 320(6): C1112-C1124.
40. Ahmed A, Joshi IM, Larson S, Gholizadeh S, Forouzandeh F, Borkholder DA, **Gaborski TR** and Abhyankar AA. Microengineered Three-Dimensional Collagen Landscapes with Independently Tunable Fiber Anisotropy and Directionality. *Advanced Materials Technologies*. 2021. 6(4): 2001186.
39. Rode RP, Chung HH, Miller HN, **Gaborski TR** and Moghaddam S. Trilayer Interlinked Graphene Oxide Membrane for Wearable Hemodialyzer. *Advanced Materials Interfaces*. 2021. 8(3): 2170011. (**Cover Illustration**).
38. Gholizadeh S, Allahyari Z, Carter RN, Delgadillo LF, Marchi N and **Gaborski TR**. Robust Variable and Gradient Thickness Membranes for Tissue Barrier Models. *Advanced Materials Technologies*. 2020. 5(12): 2000474.
37. Salminen AT, Tiothof J, Izhiman Y, Masters EA, McCloskey MC, **Gaborski TR**, Kelley DH, Pietropaoli AP, Waugh RE and McGrath JL. Endothelial Cell Apicobasal Polarity Facilitates Distinct IL-8 Secretion and Immune Responses to Systemic vs. Local Inflammation. *Integrative Biology*. 2020. 12(11): 275–289.
36. Salminen AT, Allahyari Z, Gholizadeh S, McCloskey MC, Ajalik R, Cottle RN, **Gaborski TR** and McGrath JL. In Vitro Studies of Transendothelial Migration for Biological and Drug Discovery. *Frontiers in Medical Technology*. 2020. 2: 600616.
35. Ramirez MM, Soule CW, Dehghani M and **Gaborski TR**. Use of Nanosphere self-assembly to pattern ultrathin membranes for the study of extracellular Vesicles. *Nanoscale Advances*, 2020. 2, 4427-4436. (**Cover Illustration**)
34. Lucas K, Ahmad SD, Dehghani M, **Gaborski TR** and McGrath JL. Critical Flux Behavior of Ultrathin Silicon Nanomembranes. *Separation and Purification Technology*. 2020. 251:117342.
33. Dehghani M, Gulvin SM, Flax J and **Gaborski TR**. Systematic evaluation of PKH Labelling on extracellular Vesicle Size by nanoparticle tracking Analysis. *Scientific Reports*. 2020. 10:9533.
32. Miller JJ, Carter JA, Hill K, DesOrmeaux JPS, Carter RN, **Gaborski TR**, Roussie JA, McGrath JL and Johnson DG. Free Standing, Large Area Silicon Nitride Membranes for High Toxin Clearance and Small Format Hemodialysis. *Membranes*. 2020. 10(6): 119.
31. Piazza N, Dehghani M, **Gaborski TR** and Wuertz-Kozak K. Therapeutic potential of extracellular vesicles in degenerative diseases of the intervertebral disc. *Frontiers Bioengineering and Biotechnology*. 2020. 8:311.
30. Khire TS, Salminen AT, Swamy H, Lucas KS, McCloskey MC, Ajalik RE, Chung HH, **Gaborski TR**, Waugh RE, Glading AJ and McGrath JL. et al. Microvascular Mimetics for the Study of Leukocyte-Endothelial Interactions. *Cellular and Molecular Bioengineering*. 2020. 13:125-139. (**Cover Illustration**)
29. Hill K, Walker SN, Salminen A, Chung HL, Li Z, Ezzat B, Miller JJ, Desormeaux JP, Zhang J, Hayden A, Burgin T, Piraino L, May MN, **Gaborski TR**, Roussie JA, Taylor J, DiVicenti L, Shestopalov AA, McGrath JL and Johnson DG. Second Generation Nanoporous Silicon Nitride Membranes for High Toxin Clearance and Small Format Hemodialysis. *Advanced Healthcare Materials*. 2020 9(4):1900750.

28. Allahyari Z, Gholizadeh S, Chung HH, Delgadillo, LF and **Gaborski TR**. Micropatterned Poly(ethylene glycol) Islands Disrupt Endothelial Cell–Substrate Interactions Differently from Microporous Membranes. *ACS Biomaterials Science & Engineering*. 2020. 6(2):959-968.
27. Dehghani M, Luca K, Flax J, McGrath J and **Gaborski TR**. Tangential flow microfluidics for the capture and release of nanoparticles and extracellular vesicles on conventional and ultrathin membranes. *Advanced Materials Technologies*. 2019 4(11): 1900539.
26. Salminen AT, Zhang J, Madejski GR, Khire TS, Waugh RE, McGrath JL and **Gaborski TR**. Ultrathin Dual-Scale Nano- and Micro-Porous Membranes for Vascular Transmigration Models. *Small*. 2019. 15(6): 1804111. (**Cover Illustration**)
25. Chung HH, Bellefeuille S, Miller HN and **Gaborski TR**. Extended live-tracking and quantitative characterization of wound healing and cell migration with SiR-Hoechst. *Experimental Cell Research*. 2018. 1-2:198-210.
24. Chung HH, Ramirez MM, Kwarta BJ and **Gaborski TR**. Use of Porous membranes in tissue barrier and co-culture models. *Lab on a Chip*. 2018. 18:1671-1689.
23. Chung HH, Casillo SM, Perry SJ and **Gaborski TR**. Porous substrates promote early endothelial migration at the expense of fibronectin fibrillogenesis. *ACS Biomaterials Science & Engineering*. 2018 4(1): 222-230. (**Cover Illustration**)
22. Ramirez MM and **Gaborski TR**. Fabrication Techniques Enabling Ultrathin Nanostructured Membranes for Separations. *Electrophoresis*. 2017. 38 (19): 2374-2388.
21. Casillo SM, Peredo AP, Perry SJ, Chung HH and **Gaborski TR**. Membrane pore spacing can modulate endothelial cell-substrate and cell-cell interactions. *ACS Biomaterials Science & Engineering*. 2017. 3(3): 243-248.
20. Carter RN, Casillo SM, Mazzocchi AR, DesOrmeaux JS, Roussie JA and **Gaborski TR**. Ultrathin transparent membranes for cellular barrier and co-culture models. *Biofabrication*. 2017. 9(1): 015019.
19. Winans JD, Smith KJP, **Gaborski TR**, Roussie JA, McGrath JL. Membrane capacity and fouling mechanisms for ultrathin nanomembranes in dead-end filtration. *Journal of Membrane Science*. 2016. 499: 282-289.
18. Qi C, Striemer CC, **Gaborski TR**, McGrath JL and Fauchet PM. Influence of silicon dioxide capping layers on pore characteristics in nanocrystalline silicon membranes. *Nanotechnology*. 2015. 26 (5): 055706.
17. Miller JJ, Carter RN, McNabb KB, Winans JD, DesOrmeaux JS, Striemer CC and **Gaborski TR**. Lift-off of Large-Scale Ultrathin Nanomembranes. *Journal of Micromechanics and Microengineering*. 2015. 25 (1): 015011.
16. Nehilla BJ, Nataraj N, **Gaborski TR** and McGrath JL. Endothelial Vacuolization Induced by Highly-permeable Silicon Membranes. *Acta Biomaterialia*. 2014. 10 (11): 4670-4677.
15. DesOrmeaux JS, Winans JD, Wayson SE, **Gaborski TR**, Khire TS, Striemer CC and McGrath JL. Nanoporous Silicon Nitride Membranes Fabricated from Porous Nanocrystalline Silicon Templates. *Nanoscale*. 2014. 6 (18): 10798-10805.
14. Mazzocchi AR, Man AJ, DesOrmeaux JS and **Gaborski TR**. Porous membranes Promote Endothelial Differentiation of Adipose-Derived Stem Cells and Perivascular Interactions. *Cellular and Molecular Bioengineering*. 2014. 7(3): 369-378.
13. Qi C, Striemer CC, **Gaborski TR**, McGrath JL and Fauchet PM. Highly Porous Silicon Membranes Fabricated from Silicon Nitride/Silicon Stacks. *Small*. 2014. 10(14): 2946–2953.
12. **Gaborski TR**, Sealander MN, Waugh RE and McGrath JL. Dynamics of adhesion molecule domains on neutrophil membranes: Surfing the dynamic cell topography. *European Biophysics Journal*. 2013. 42(11-12):851-855.
11. Snyder JL, Getpreecharsawas J, Fang DZ, **Gaborski TR**, Striemer CS, Fauchet PM, Borkholder DA and McGrath JL. High performance, low voltage electroosmotic pumps with molecularly thin nanoporous silicon membranes. *PNAS*. 2013. 110(46):18424-30.
10. Johnson DG, Khire TS, Lyubarskaya YL, Smith KJ, DesOrmeaux JS, Taylor JG, **Gaborski TR**, Shestopalov AA, Striemer CC, McGrath JL. Ultrathin Silicon Membranes for Wearable Hemodialysis. *Advances in Chronic Kidney Disease*. 2013. 20 (6): 508-515.
9. Kavalenka MN, Striemer CC, Fang DZ, Shome K, **Gaborski TR**, McGrath JL, Fauchet PM. Ballistic and non-ballistic gas flow through ultrathin nanopores. *Nanotechnology*. 2012. 13;23(14):145706.
8. Snyder JL, Clark A Jr., Fang DZ, **Gaborski TR**, Striemer CC, Fauchet PM, McGrath JL. An experimental and theoretical analysis of molecular separations by diffusion through ultrathin nanoporous membranes. *J Memb Sci*. 2011. 1;369(1-2):119-129.
7. **Gaborski TR**, Snyder JL, Striemer CC, Fang DZ, Hoffman M, Fauchet PM, McGrath JL. High Performance Separation of Nanoparticles with Ultrathin Porous Nanocrystalline Silicon (pnc-Si) membranes. *ACS Nano*. 2010. 23; 4(11):6973-81.
6. Fang DZ, Striemer CS, **Gaborski TR**, McGrath JL and Fauchet PM. Methods for controlling the morphology of ultra-thin porous nanocrystalline silicon membranes. *J Phys: Condens Matter* 2010 Nov 17; 22(45):4134

5. Fang DZ, Striemer CS, **Gaborski TR**, McGrath JL, Fauchet PM. Pore size control of ultra-thin silicon membranes by rapid thermal carbonization. *Nano Letters*. 2010. 10(10):3904-8.
4. Agrawal AA, Nehilla BJ, Reisig KV, **Gaborski TR**, Fang DZ, Striemer CC, Fauchet PM, McGrath JL. Porous nanocrystalline silicon as a substrate for cell culture experiments. *Biomaterials*. 2010. 31(20):5408-17.
3. **Gaborski TR**, Sealander MN, Ehrenberg MS, Waugh RE, McGrath JL. Image Correlation Microscopy for Mobility and Cluster Measurements Using Uniform Illumination. *Journal of Microscopy*. 2010. 237(1):39-50.
2. **Gaborski TR**, Clark Jr A, Waugh RE, McGrath JL. Membrane mobility of beta2 integrins and rolling associated adhesion molecules on resting neutrophils. *Biophysical Journal*. 2008. 95(10):4934-47.
1. Striemer CC, **Gaborski TR**, McGrath JL, Fauchet PM. Charge- and size-based separation of macromolecules using ultrathin silicon membranes. *Nature*. 2007. 445(7129):749-53.

## BOOK CHAPTERS

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1. M Dehghani and **TR Gaborski**. Fluorescent Labeling of Extracellular Vesicles. *Extracellular Vesicles Vol. 45. Methods of Enzymology*. Academic Press, New York, 2020.
2. **TR Gaborski** and JL McGrath. Dynamics of the Neutrophil Surface During Emigration from Blood. *Principles of Cellular Engineering: Understanding the Biomolecular Interface*. Academic Press, New York, 2006.

## PATENTS (4 ISSUED, 3 ADDITIONAL APPLICATIONS)

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4. CC Striemer, PM Fauchet, **TR Gaborski**, and JL McGrath, "Ultrathin Porous Nanoscale Membranes, Methods of Making, and Uses Thereof," US Patent No. 8,518,276, Issued May 27, 2013. (*Licensed*)
3. CC Striemer, PM Fauchet, **TR Gaborski**, and JL McGrath, "Ultrathin Porous Nanoscale Membranes, Methods of Making, and Uses Thereof," US Patent No. 8,182,590, Issued May 22, 2012. (*Licensed*)
2. JL McGrath, **TR Gaborski**, JL Snyder, CC Striemer, PM Fauchet, and M. Springer, "Cell Culture Devices Having Ultrathin Porous Membrane and Uses Thereof," US Patent No. 8,119,394, Issued February 21, 2012. (*Licensed*)
1. JL McGrath, IM Schwartz, M Bindschalter, M Ehrenberg, and **TR Gaborski**. "Nanofabrication using actin filaments." US Patent No. 7,193,054. Issued March 20, 2007.

## SELECT CONFERENCE PLATFORM PRESENTATIONS AND INVITED TALKS (2012-PRESENT)

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30. The Discontinuous Surface of Porous Membranes Can be Engineered to Reduce Cell-Substrate Interactions Similarly to Soft Materials. American Institute for Chemical Engineering Annual Meeting. Phoenix, AZ. November 14, 2022.
29. Development of Nanopocket Membranes for the Purification and Fractionation of Extracellular Vesicle Subpopulations. Exosomes, Microvesicles and Other Extracellular Vesicles Keystone Symposia. Santa Fe, NM. November 2, 2022. (Invited)
28. How a serendipitous discovery and side project led to the founding of a nanomaterials company. Northeast Regional Meeting of the American Chemical Society (ACS). Rochester, NY. October 5, 2022. (Invited)
27. Towards the Development of Nanopocket Membranes for the Purification and Fractionation of Extracellular Vesicle Subpopulations. Northeast Regional Meeting of the American Chemical Society (ACS). Rochester, NY. October 4, 2022. (Invited)
26. Towards the Development of Nanopocket Membranes for the Purification and Fractionation of Extracellular Vesicle Subpopulations. The Ohio State University and Nationwide Children's Hospital. July 28, 2022. (Invited)
25. Engineering the Ideal Membrane: in vitro Tissue Barrier and Cellular Co-Culture Models. University of Massachusetts - Amherst. Amherst, MA. March 24, 2022. (Invited)
24. Engineering the Ideal Membrane: in vitro Tissue Barrier and Cellular Co-Culture Models. Brandeis University. Waltham, MA. January 24, 2022. (Invited)
23. Development of Nanopocket Membranes for the Purification and Fractionation of Extracellular Vesicles. American Institute of Chemical Engineers Annual Meeting. Boston, MA. November 10, 2021.
22. Engineering the Ideal Membrane: in vitro Tissue Barrier and Cellular Co-Culture Models. Syracuse Biomaterials Institute. Syracuse, NY. October 20, 2021. (Invited)
21. Development of nanopocket membranes for tangential flow analyte capture (TFAC) of extracellular vesicles. North American Membrane Society Annual Meeting. Phoenix, AZ – Virtual. May 20, 2020.
20. Engineering porous membranes to optimize in vitro cellular barrier models. IEEE Nanomedicine. Waikiki, HI. December 4, 2018. (Invited)
19. Transparent Ultrathin Porous Membranes for Cellular Barrier & Co-Culture Models. Biomedical Engineering Department Seminar. Vanderbilt University. Nashville, TN. March 14, 2018. (Invited)

18. From Academia to Startup Life and Back Again. Biochemistry & Cellular and Molecular Biology Department Seminar Series. University of Tennessee. Knoxville, TN. February 28, 2018. (Invited)
17. Transparent Ultrathin Porous Membranes for Cellular Barrier & Co-Culture Models. Biomedical Engineering Department Seminar. University of Toledo. Toledo, OH. September 15, 2017. (Invited)
16. Capture and Release of Extracellular Vesicles on Nanoporous Membranes. ASME International Conference on Mini Micro and Nanochannels. Boston, MA. August 30, 2017.
15. Transparent and ultrathin nanomembranes for cellular barrier and co-culture models. Biomedical Engineering Society Annual Meeting. Minneapolis, MN. October 7, 2016.
14. Focus Group. Foresight Institute Atomic Precision Workshop. Breakthrough Technologies for Energy. Palo Alto, CA. May 20-22, 2016. (Invited)
13. BME 6670 – Bionanotechnology. Improving human health with nanotechnology - A case study on hemodialysis. Cornell University. Ithaca, NY. November 17, 2015. (Invited Guest Lecture)
12. Ultrathin silicon-based nanomembranes for Biomedical Applications. Mechanical Engineering Department Seminar. University of Florida. Gainesville, FL. October 13, 2015. (Invited)
11. Ultrathin silicon-based nanomembranes can revolutionize biological separations and serve as advanced cell culture platforms. ASME International Conference on Nano-, Micro- and Mini-Channels. July 7, 2015. (Invited)
10. Ultrathin Membranes Promote Endothelial Differentiation of Adipose-Derived Stem Cells. Invited Presentation. World Stem Cell and Regenerative Medicine Congress. London, UK. May 22, 2015. (Invited)
9. BME 6670 – Bionanotechnology. Improving human health with nanotechnology - A case study on hemodialysis. Cornell University. Ithaca, NY. November 13, 2014. (Invited Guest Lecture)
8. Porous membranes Promote Endothelial Differentiation of Adipose-Derived Stem Cells and Perivascular Interactions. Young Innovator Award Session. Biomedical Engineering Society Annual Meeting. San Antonio, TX. October 25, 2014. (Invited)
7. BME 6670 – Bionanotechnology. Improving human health with nanotechnology - A case study on hemodialysis. Cornell University. Ithaca, NY. October 29, 2013. (Invited Guest Lecture)
6. Low-Voltage Electroosmotic Flow and DNA Shearing Using Ultrathin Nanoporous Silicon Membranes. Platform Talk. Biomedical Engineering Society Annual Meeting. Seattle, WA. September 28, 2013.
5. Highly Permeable, Transparent and Degradable Membranes for Tissue Scaffolding. Platform Talk. Microscopy and Microanalysis Annual Meeting. Indianapolis, IN. August 6, 2013.
4. Low voltage electroosmotic pumps for lab-on-a-chip applications using molecularly thin silicon membranes. IEEE Electronic Devices Society of Western NY Annual Meeting. November 14, 2012. (Invited Keynote Talk)
3. BME 6670 – Bionanotechnology. Improving human health with nanotechnology - A case study on hemodialysis. Cornell University. Ithaca, NY. October 16, 2012. (Invited Guest Lecture)
2. Dynamics of Adhesion Molecule Domains on Neutrophil Membranes. Microscopy & Microanalysis. July 31, 2012. Phoenix, AZ.
1. Optically Transparent and Permeable Microarrays for Cellular Assays. Microscopy & Microanalysis. August 1, 2012. Phoenix, AZ.

## EXTERNAL FUNDING

### ACTIVE PROJECTS (7)

MCB 2229111 Future Manufacturing  
National Science Foundation

1/1/23-12/31/24

**FMSG: Bio: Advancing Extracellular Vesicle Biomanufacturing of CRISPR-Edited Human iPSC-derived MSCs with Next-Generation Purification**

The goal of this project is to enable scale-up biomanufacturing potentials of MSC-derived small extracellular vesicles (EVs) by integrating human induced pluripotent stem cells (hiPSCs) for scalability in donor cell source, synthetic biology tools for scalability in exosome biogenesis, and advanced nano-membrane technology for scalability in small EV purification.

**Role: Co-I \$159,875 to Gaborski**

R21 GM146156  
National Institutes of Health/NIGMS

6/1/22-5/31/24

**Development of size-selective capture and release membranes for purification of extracellular vesicles**

The goals of this project are to size-selectively separate and purify human extracellular vesicle subpopulations through development of a nanomembrane device as well as incorporate inline technologies to remove contaminating lipoprotein nanoparticles commonly found in plasma.

**Role: PI \$406,938 to Gaborski**

Hank and Lynn Hopeman Foundation

4/1/22-3/31/23

**Understanding and Modulating the Permeability of the Blood-Brain-Barrier to Study Transport of Synthetic and Natural Biomolecules to the Brain**

The goal of this feasibility project is to use our tissue-on-a-chip platform of the blood-brain barrier and our studies of the barrier breakdown to learn how we might intentionally and temporarily reduce barrier integrity to allow drugs to transit this barrier to treat neurological diseases. Additionally, we seek to understand whether extracellular vesicles may be constrained by the basement membrane matrix but released during barrier breakdown.

**Role: PI \$100,000 to Gaborski**

R44GM137651

National Institutes of Health/NIGMS

3/1/22-2/28/24

**Commercializing the  $\mu$ SIM: A Modular Platform for the Development and Analysis of Barrier Tissue Models**

Gaborski's role as a Co-I is to develop and fabricate soft and more physiologically-relevant membranes for the membrane module.

**Role: Co-I; \$143,179 to Gaborski**

R21 AI163782

6/9/21-5/31/23

National Institutes of Health/NIAID

**Using nanopocket membranes to capture bacterial outer membrane vesicles from biofluids**

The goals of this project are to identify whether bacterial outer membrane vesicles (OMVs) could be a molecular diagnostic biomarker for sepsis *and* develop a rapid approach to isolate them from patient plasma. We seek to develop a straightforward high-purity and rapid separation technology that effectively isolates and purifies OMVs from biofluids, including plasma.

**Role: Multi-PI (Michel and Gaborski); \$208,501 to Gaborski**

Sartorius-Stedim Sponsored Research

6/1/21-12/31/22

**Feasibility of Size Measurement and Characterization of Nanoparticles Using a Sartorius Virus Counter**

The major goal of this project is to investigate the feasibility of characterizing nanoparticles and extracellular vesicles using a Sartorius Virus Counter (VC) instrument.

**Role: PI; \$281,733 to Gaborski**

R61 & R33 HL154249

9/3/20-8/31/25

National Institutes of Health/NHLBI

**The  $\mu$ SiM-hNVU - a human BBB platform for the study of brain injury mechanisms during systemic infection**

The study of brain injury in sepsis and other forms of systemic inflammation is limited by a lack of *in vitro* tools that model the interface between the blood and brain. This project will address this unmet need by building a human neurovascular unit chip where circulating factors are introduced on the 'blood side' and a microglia report on inflammatory status on the 'brain side.'

**Role: Multi-PI (McGrath, Englehart, Gaborski, Singer and Waugh); \$504,918 to Gaborski**

**COMPLETED PROJECTS AND EQUIPMENT SUPPLEMENTS (15)**

R35 GM119623

9/1/16-5/31/22

National Institutes of Health/NIGMS

**Transparent Ultrathin Nanomembranes for Barrier Cell Models and Novel Co-Culture Systems**

The goal of this work is to develop novel ultrathin membranes to improve and enable *in vitro* cellular barrier models and co-culture systems and optimize design through study of cell-substrate interactions.

**Role: PI; \$1,815,287 to Gaborski**

R35 GM119623-S5

2020

National Institutes of Health/NIGMS

**Administrative Equipment Supplement**

This administrative equipment supplement supports the purchase of a dedicated parylene deposition system that will be used to produce ultrathin polymer films that will be developed into porous membranes.

**Role: PI; \$51,309 to Gaborski**

- R21 EB023527 7/15/17-4/30/20  
National Institutes of Health/NIBIB  
**Plasma clearance of water-soluble and albumin-bound toxins using graphene oxide nanoengineered laminates**  
The goal of this work is to engineer graphene oxide membranes and adsorbent matrices to remove both water-soluble and albumin-bound toxins from blood to investigate the feasibility of use in hemodialysis and liver-assist devices.  
**Role: Multi-PI (Moghaddam and Gaborski); \$175,816 to Gaborski**
- R35 GM119623-S4 2019  
National Institutes of Health/NIGMS  
**Administrative Equipment Supplement**  
This administrative equipment supplement supports the complete environmental control of an existing wide-field microscope and z-stack image acquisition for time-lapse imaging of 2D and 3D cellular transmigration across tissue barrier models.  
**Role: PI; \$55,778 to Gaborski**
- STTR Phase II 1660177 4/1/17-3/31/19  
National Science Foundation  
**Development of ultrathin silicon nitride nanomembrane for prototype dialysis modules targeted for home hemodialysis**  
The goal of this work is to optimize lift-off of large sheets of ultrathin nanomembranes and incorporate membranes in miniature dialyzer cartridges for benchtop experiments and small animal trials and to purify cellular exosomes.  
**Role: Co-PI; \$79,332 to Gaborski**
- R35 GM119623-S3 2018  
National Institutes of Health/NIGMS  
**Administrative Equipment Supplement**  
This administrative equipment supplement is funding the purchase of an ultracentrifuge to assist in the isolation and purification of extracellular vesicles. This will support our work in studying the cellular communication in co-culture systems via microvesicles, exosomes and small signaling molecules.  
**Role: PI; \$53,325 to Gaborski**
- New York Empire State Economic Development Fund 2018  
**Cell and Tissue Technologies Laboratory**  
This NYESED award is funding the acquisition of specialized wet lab equipment to facilitate interaction between academic researchers and the private sector. Equipment includes a Nanoparticle Analyzer, Cell Culture and Molecular Biology tools.  
**Role: Co-PI; \$110,000**
- STTR Phase I 1521373 7/1/15-8/31/16  
National Science Foundation  
**Development of ultrathin silicon nitride nanomembrane for prototype dialysis modules targeted for home hemodialysis**  
The goal of this work was to optimize lift-off of large sheets of ultrathin nanomembranes and incorporate membranes in miniature dialyzer cartridges for benchtop experiments and small animal trials.  
**Role: Co-PI; \$60,577 to Gaborski**
- NYSTAR/CEIS 9/1/15-6/30/16  
**Feasibility of Large Area Nanoporous Silicon Membranes for Bioprocess Filtration**  
The goal of this work was to demonstrate the feasibility of using ultrathin nanomembranes in a custom tangential flow filtration device to purify and isolate biomolecules including exosomes.  
**Role: PI; \$24,437 to Gaborski**
- NYSTAR/CEIS 12/1/14-3/31/15  
**Feasibility of Large Area Nanoporous Silicon Membranes for Hemodialysis**  
The goal of this work was to demonstrate the feasibility of creating large sheets of ultrathin nanomembranes using a MEMS lift-off approach and incorporating a patterned polymeric scaffold to provide mechanical support.  
**Role: Co-PI; \$26,064 to Gaborski**



NYSTAR/CEIS

1/1/13-8/31/13

**Cellular Co-Culture Microarrays for High-Throughput Screening**

The goal of this work was to demonstrate the feasibility of a patterned hydrogel microarray supported on a porous membrane for co-culture screening applications.

**Role: PI; \$26,222 to Gaborski**

R43 RR033156

9/20/11-9/19/12

National Institutes of Health/NCRR

**Microfabricated porous TEM grids for improved phase contrast and CryoEM imaging**

The goal of this work was to demonstrate feasibility of a microfabrication technology for manufacturing Zernike phase plates for contrast enhancement in electron microscopy (EM) tomography and cryo-EM imaging.

**Role: Multi-PI (Gaborski, Marko and Strierner); \$155,819 to Gaborski**

R43 GM097792

9/01/11-5/31/12

National Institutes of Health/NIGMS

**Nanoporous membranes for cellular microarrays and in vitro assays**

The goal of this work was to develop miniaturized arrays for high-throughput cell-based drug screens and culture assays for cellular co-culture research including stem cell differentiation.

**Role: PI; \$184,665 to Gaborski**

R43 GM090498

9/01/10-10/31/11

National Institutes of Health/NIGMS

**Nanoporous silicon membranes for protein purification**

The goal of this proposal was to determine the feasibility of using a novel nanoporous membrane technology to rapidly purify and isolate proteins and other biomolecules.

**Role: PI; \$153,245 to Gaborski**

F31 EB005103

6/1/05-5/31/08

National Institutes of Health/NIBIB

**Analysis of physical mechanisms of cell adhesion**

This individual predoctoral fellowship sponsored research into understanding the mechanisms of adhesion molecule mobility and topological positioning on human neutrophils.

**Role: Graduate Fellow; \$125,019 to Gaborski**

## SERVICE (ROCHESTER INSTITUTE OF TECHNOLOGY)

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|                                                                                                   |              |
|---------------------------------------------------------------------------------------------------|--------------|
| Co-Chair of Search Committee for Assoc Provost & Dean of Graduate College                         | 2022         |
| Faculty Co-Lead on Renovations of Engineering Hall for Nano Bio Labs and Instrumentation Facility | 2021-present |
| Co-Lead on Development of RIT Biomedical Engineering M.S. Degree                                  | 2021-present |
| College of Engineering Graduate Curriculum Committee                                              | 2021-present |
| Biomedical and Chemical Engineering Ph.D. Program Admissions Committee Chair                      | 2020-Present |
| Director, Biomedical and Chemical Engineering Ph.D. Program                                       | 2020-Present |
| RIT   nano Cleanroom Advisory Committee                                                           | 2020-Present |
| Organizer and Lead of the Biomedical Engineering Research Seminar Series                          | 2019-Present |
| Institute Future of Faculty Committee                                                             | 2018-Present |
| Faculty Advisor to the RIT Cycling Team                                                           | 2012-Present |
| BME Department Undergraduate Curriculum Committee                                                 | 2012-2020    |
| Science & Engineering Research Building Visioning Committee, Strategy Subcommittee Chair          | 2019-2020    |
| College of Engineering Research and Strategy Committee                                            | 2018-2020    |
| Chair of Faculty Search Committee, Biomedical Engineering, College of Engineering (2 openings)    | 2018-2019    |
| Institute Research and Strategy Committee                                                         | 2017-2019    |
| RIT BMES Club Faculty Advisor                                                                     | 2016-2018    |
| Faculty Search Committee, Biomedical Engineering, College of Engineering                          | 2016-2017    |
| Dean Search Committee, Kate Gleason College of Engineering                                        | 2015-2016    |
| BME Co-op Faculty Liaison                                                                         | 2013-2016    |
| Faculty Search Committee, Biotechnology, School of Life Sciences                                  | 2013-2014    |
| Faculty Search Committee (2 Openings), Biomedical Engineering, College of Engineering             | 2012-2013    |
| Faculty Search Committee (2 Openings), Biomedical Engineering, College of Engineering             | 2012         |

## SERVICE (EXTERNAL)

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Grant Proposal Panel and Study Section Reviewer:</b> National Institutes of Health (NIH) Innovative Molecular Analysis Technologies, NIH Innovative Biospecimen Science Technologies for Basic and Clinical Cancer Research, and National Science Foundation (NSF) Division of Civil, Mechanical, and Manufacturing Innovation.                                                                                                                     |              |
| <b>Ad hoc Grant Proposal Reviewer:</b> Natural Sciences and Engineering Research Council of Canada (NSERC), Israeli Ministry of Science, Technology and Space, and Netherlands Organization for Scientific Research.                                                                                                                                                                                                                                   |              |
| <b>Journal Editorial Board Member:</b> Micromachines, Membranes.                                                                                                                                                                                                                                                                                                                                                                                       |              |
| <b>Past and Present Journal Reviewer:</b> ACS Applied Materials & Interfaces, ACS Biomaterials Science & Engineering, ACS Nano, Acta Biomaterialia, Biofabrication, Biophysical Journal, Biotechnology Advances, Biotechnology and Bioengineering, Cellular and Molecular Bioengineering, Electrophoresis, Journal of Extracellular Vesicles, Journal of Membrane Science, Lab on a Chip, Nanomedicine, Nature Communications, and Scientific Reports. |              |
| Founder and Co-Administrator, MidCareer PI Slack                                                                                                                                                                                                                                                                                                                                                                                                       | 2017-Present |
| Abstract reviewer for the Annual BMES Conference                                                                                                                                                                                                                                                                                                                                                                                                       | 2013-Present |
| Organizer & Chair – Transport in Membranes & Nanofluids Track, ASME ICNMM Annual Meeting                                                                                                                                                                                                                                                                                                                                                               | 2016, 2017   |
| Co-Chair, Advances in Micro/Nano Manufacturing Platform Session, BMES Annual Meeting                                                                                                                                                                                                                                                                                                                                                                   | 2016         |
| Organizer of Demo Day @ RIT, Nanotechnology Summer Camp, Rochester Museum & Science Center                                                                                                                                                                                                                                                                                                                                                             | 2014         |
| Co-Chair, Stem Cell Environments and Differentiation, BMES Annual Meeting                                                                                                                                                                                                                                                                                                                                                                              | 2014         |
| Co-Chair, Mechanobiology and Stem Cell Translation Poster Session, BMES Annual Meeting                                                                                                                                                                                                                                                                                                                                                                 | 2014         |
| Co-Chair, Microphysiology Systems Platform Session, BMES Annual Meeting                                                                                                                                                                                                                                                                                                                                                                                | 2013         |
| Rochester NanoDays Event, Rochester Museum & Science Center                                                                                                                                                                                                                                                                                                                                                                                            | 2012-2015    |

## PAST AND PRESENT RESEARCH TEAM MEMBERS

**Postdoctoral Researchers**

|                                                                              |              |
|------------------------------------------------------------------------------|--------------|
| Alan Man, <i>now Assoc Professor, Engineering, Pierce College</i>            | 2012-2013    |
| Robert Carter, <i>now Assoc Department Head, Mechanical Engineering, RIT</i> | 2013-2015    |
| Henry Chung, <i>now Project Engineer, Triton Systems</i>                     | 2016-2019    |
| Marcela Mireles, <i>now Research Engineer, University of Rochester</i>       | 2016-2019    |
| Kevin Petersen                                                               | 2022-Present |

**Research Technicians**

|               |              |
|---------------|--------------|
| Jason Gerbsch | 2022-Present |
|---------------|--------------|

**Ph.D. Students**

|                                                                                    |              |
|------------------------------------------------------------------------------------|--------------|
| Mehdi Aslan Dehghani, <i>now Scientist, Sartorius Stedim</i>                       | 2015-2020    |
| Alec Salminen (Co-advised with James McGrath), <i>now ORISE Postdoc at FDA</i>     | 2015-2021    |
| Shayan Gholizadeh, <i>now Postdoc at Harvard Medical School</i>                    | 2017-2022    |
| Zahra Allahyari, <i>now Postdoc at Harvard Medical School</i>                      | 2017-2022    |
| Adeel Ahmed (co-advised with Vinay Abhyankar), <i>now Postdoc at UWisc-Madison</i> | 2017-2022    |
| Munther Alsudais                                                                   | 2019-Present |
| Louis Widom                                                                        | 2019-Present |
| Panteha Torabian                                                                   | 2021-Present |
| Atiyeh Hosseinifakh                                                                | 2021-Present |
| Nadezhda Nikiforova                                                                | 2022-Present |

**Master's Students**

|                                                                        | <b>graduation year</b> |
|------------------------------------------------------------------------|------------------------|
| Cody Soule ( <i>now Principal Process Engineer, Global Foundries</i> ) | 2018                   |
| David Hurley                                                           | 2018                   |
| Stephanie Boula ( <i>now Project Manager, Confluent Medical</i> )      | 2019                   |
| Daniella Lincoln ( <i>now Process Engineer, Bausch + Lomb</i> )        | 2021                   |

**Undergraduate Students**

|                     | <b>graduation year</b> |
|---------------------|------------------------|
| Joshua Miller       | 2013                   |
| Katelyn Busse       | 2016                   |
| Alex Dawson-Elli    | 2016                   |
| Michael Potter      | 2016                   |
| Zachary Oppito      | 2016                   |
| Jascha Wilcox       | 2016                   |
| Andrea Mazzocchi    | 2016                   |
| Elizabeth Stoyan    | 2016                   |
| Randi Del Rosario   | 2017                   |
| Melissa Mendoza     | 2017                   |
| Ana Peredo          | 2017                   |
| Spencer Perry       | 2017                   |
| Stephanie Casillo   | 2018                   |
| Elizabeth Hirschman | 2018                   |
| Shane Peechatka     | 2018                   |
| Sean Bellefeuille   | 2019                   |
| Phillip Tinder      | 2019                   |
| Shannon Gulvin      | 2020                   |
| Nikki VanOstrand    | 2021                   |
| Hayley Miller       | 2021                   |
| Sarah Henretta      | 2022                   |
| Zoii Henry          | 2023 (anticipated)     |
| Daniel DiMartino    | 2023 (anticipated)     |
| Anna Kasper         | 2023 (anticipated)     |
| Cara Guernsey       | 2023 (anticipated)     |
| Jess Ritz           | 2024 (anticipated)     |
| Leanna Frasch       | 2025 (anticipated)     |