

**Curriculum Vitae****Ned B. Bowden**

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**EDUCATIONAL AND PROFESSIONAL HISTORY**

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**Education**

1994 – 1999 M.S. in 1997, Ph.D. in 1999  
 Harvard University, Department of Chemistry  
 Advisor: Professor George M. Whitesides

1990 – 1994 B.S. in 1994  
 California Institute of Technology, Department of Chemistry  
 Advisor: Robert H. Grubbs

**Professional Appointments**

2020 – present Professor, Department of Chemistry  
 University of Iowa

2009 – 2020 Associate Professor, Department of Chemistry  
 University of Iowa

2002 – 2009 Assistant Professor, Department of Chemistry  
 University of Iowa

2000 – 2002 Post-doctoral Scientist, Mentor: Robert Waymouth  
 Stanford University, Department of Chemistry

1999 Post-doctoral Scientist, Mentor: George Whitesides  
 Harvard University, Department of Chemistry

**Honors and Awards**

2018-present Associate Editor for *ACS Applied Nano Materials*

2014 University of Iowa Inventor Award

2009 University Housing Academic Excellence Award

2005 American Cancer Society Grant for New Avenues of Research

2003 American Chemical Society: Petroleum Research Fund Type G Award

2003 Research Corporation: Research Innovation Award

2000 – 2002 Postdoctoral Fellowship Based in the Center on Polymer Interfaces and Macromolecular Assemblies

1994 – 1997 Predoctoral Fellowship from the Department of Defense

1994 American Institute of Chemists Foundation Student Award for Outstanding Senior Majoring in Chemistry

1993 – 1994 Barry Goldwater Scholarship

1992 – 1993 Richard P. Schuster Memorial Prize to Outstanding Junior or Senior in Chemistry

1992 – 1994 Caltech Carnation Scholarship

1993 Academic All-American in Collegiate Cross Country

**Membership**

1992 – Present	American Chemical Society Division of Polymer Chemistry, Division of Polymeric Materials: Science and Engineering, and Division of Colloid and Surface Chemistry
1996 – 2018	American Association for the Advancement of Science
2003	Materials Research Society
2013 – 2018	American Oil Chemists Society

### **CONSULTING ACTIVITIES**

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Starting in May of 2020 I served as an expert witness in a patent infringement case. I filed an expert report on the infringement of patents and a rebuttal report about the report by the opposing side's expert witness. I was deposed in 2020, and I expect to testify in 2021 if the case goes to trial.

### **START-UP COMPANIES**

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**Theion Agriculture:** I founded Theion Agriculture with Dr. Justin Carter in 2017. We were awarded a NSF SBIR Phase I award in September of 2020. We are developing new fertilizer additives to grow crops faster and to increase the harvest yield.

**Pure Oleochemicals:** In 2014 I applied for and accepted State funding for Pure Oleo (\$100K), took investor money (\$150K), hired a COO, hired a senior scientist, moved into the BioVentures Center with a fully stocked chemistry lab, cowrote 3 SBIR grant proposals, and ran Pure Oleochemicals.

**Advanced Endovascular Therapies:** I am a founding member of a start-up company (AET) with three other faculty at the University of Iowa. We have a patent pending and are in discussions with larger companies about being bought out.

### **PATENTS AT THE UNIVERSITY OF IOWA AND HARVARD UNIVERSITY**

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Bowden, N B, Perring, M. Patent Number **US 8,981,012 B2, Issued March 17, 2015** "Modified Polydicyclopentadienes and their preparation and patterned modified polydicyclopentadienes"

Bowden, N. B., Gupta, A, Long, T R, **Patent Number: US 8,778,186 B2, Issued July 15, 2014** "High-density polydicyclopentadiene"

Bowden, N B, Kuruvilla, J D, Salem, A K, Yoo, J. **Patent Number: US 9,345,776 B2, Issued May 24, 2016**, "Biodegradable polymers with sulfenamide bonds for drug delivery applications"

Bowden, N B, Runge, M B, Miller II, A L. **Patent Number: US 8,227,635 B2, Issued July 24, 2012**, "Apparatus and method for carrying out multiple reactions"

Bowden, Ned B, Terfort, Andreas W, Carbeck, Jeffrey D, Whitesides, George M. **Patent Number: US 6,507,989. Issued July 21, 2003**, "Self-Assembly for Mesoscale Objects"

**Note:** Three more patents were filed in late 2020.

### **SCHOLARSHIP**

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70. Bowden, N. B. Nanomaterials-based membranes increase flux and selectivity to enable chemical separation. *ACS Applied Nano Materials*, **2020**, *4*, 9538-9541.

69. Wafa, E. I.; Wilson-Welder, J. H.; Hornsby, R. L.; Nally, J. E.; Geary, S. M.; Bowden, N. B.; Salem, A. K. Poly(diaminosulfide) microparticle-based vaccine for delivery of leptospiral antigens.

*Biomacromolecules*, **2020**, *21*, 534-544.

68. Do, A.-V., Smith, R., Tobias, P., Carlsen, D., Pham, E., Bowden, N. B., Salem, A. K. Sustained release of H<sub>2</sub>S from poly(lactic acid) functionalized 4-hydroxythiobenzamide microparticles to protect from oxidative damage. *Annals of Biomedical Engineering*, **2019**, *47*, 1691-1700.
67. Carter, J. M., Brown, E. M., Irish, E. E., Bowden, N. B. Characterization of dialkyldithiophosphates as slow hydrogen sulfide releasing chemicals and their effect on the growth of maize. *Journal of Agriculture and Food Chemistry*, **2019**, *67*, 11883-11892.
66. Schumacher, A. L., Gilmer, C. M., Atluri, K., Lee, J., Jugessur, A. S., Salem, A. K., Bowden, N. B., Raghavan, M. L., Hasan, D. M. Development and evaluation of a nanometer-scale hemocompatible and antithrombotic coating technology platform for commercial intracranial stents and flow diverters. *ACS Applied Nano Materials*, **2018**, *1*, 344-354.
65. Gilmer, C. M., Bowden, N. B. Reactive epoxy nanofiltration membranes with disulfide bonds for the separation of multicomponent chemical mixtures. *ACS Omega*, **2018**, *3*, 10216-10224.
64. Carter, J. M., Brown, E. M., Grace, J. P., Irish, E. E., Bowden, N. B. Improved growth of pea, lettuce, and radish plants using the slow release of hydrogen sulfide from GYY-4137. *PLoS ONE*, **2018**, *13*, e0208732.
63. Gilmer, C. M., Zvokel, C., Vick, A., Bowden, N. B. Separation of saturated fatty acids and fatty acid methyl esters with epoxy nanofiltration membranes. *RSC Advances*, **2017**, *7*, 55626-55632.
62. Gilmer, C. M., Bowden, N. B. Highly cross-linked epoxy nanofiltration membranes for the separation of organic chemicals and fish oil ethyl esters. *ACS Applied Materials & Interfaces*, **2016**, *8*, 24104-24111.
61. Geary, S. M.; Hu, Q.; Joshi, V. B.; Bowden, N. B.; Salem A. K. "Diaminosulfide based polymer microparticles as cancer vaccine delivery systems" *Journal of Controlled Release*, **2015**, *220*, 682-690.
60. Long, T. R.; Wongrakpanich, A.; Do, A.-V.; Salem, A. K.; Bowden, N. B. "Long-term release of a thiobenzamide from a backbone functionalized poly(lactic acid)" *Polymer Chemistry*, **2015**, *6*, 7188-7195.
59. D'Mello, S. R.; Yoo, J.; Bowden, N. B.; Salem, A. K. "Microparticles prepared from sulfenamide-based polymers" *Journal of Microencapsulation*, **2014**, *31*, 137-146.
58. Kitano, H.; Ramachandran, K.; Bowden, N. B.; Scranton, A. B. "Unexpected visible-light-induced free radical photopolymerization at low light intensity and high viscosity using a titanocene photoinitiator" *J. Appl. Polym. Sci.* **2013**, *128*, 611-618.
57. Gupta, A.; Bowden, N. B. "Separation of *cis*-fatty acids from saturated and *trans*-fatty acids by nanoporous polydicyclopentadiene membranes" *ACS Appl. Mater. Interfaces*, **2013**, *5*, 924-933.
- Note:** A review of this article was published in *Chemical & Engineering News*. See *Chemical & Engineering News*, **2013**, *91*, issue 6

This article was also reviewed in *Inform* which is the magazine published by the American Oil Chemists Society.

This article was highlighted in the magazine *Tribology & Lubrication Technology* that is published by the Society of Tribologists and Lubrication Engineers ([www.stle.org](http://www.stle.org)). It is read by 4,000 professionals worldwide on a monthly basis.

This article was highlighted in *Advances in Engineering* in March of 2013.

56. Graf, T. A.; Yoo, J.; Brummett, A. B.; Lin, R.; Wohlgenannt, M.; Quinn, D.; Bowden, N. B. "New polymers possessing a disulfide bond in a unique environment" *Macromolecules*, **2012**, *45*, 8193-8200.

**Note:** A review of this article and articles 55 and 54 appeared in *Chemical & Engineering News*. See *Chemical & Engineering News*, **2012**, *90*, issue 35.

55. Yoo, J.; Kuruvilla, D. J.; D'Mello, S. R.; Salem, A. K.; Bowden, N. B. "New class of biodegradable polymers formed from reactions of an inorganic functional group" *Macromolecules*, **2012**, *45*, 2292-2300.

**Note:** This article was reviewed in *Synfacts*. *Synfacts* is a journal to describe important trends and results in organic chemistry. Swager, T. M.; Mirica, K. A. "First synthesis of polysulfenamides" *Synfacts*, **2012**, *8*, 611.

54. Yoo, J.; D'Mello, S. R.; Graf, T.; Salem, A. K.; Bowden, N. B. "Synthesis of the first poly(diaminosulfide)s and an investigation of their applications as drug delivery vehicles" *Macromolecules*, **2012**, *45*, 688-697.

53. Krawczyk, B. M.; Baltrusaitis, J.; Yoder, C. M.; Vargo, T. G.; Bowden, N. B.; Kader, K. "Radio frequency glow discharge-induced acidification of fluoropolymers" *Journal of Biomedical Research Part A*, **2011**, *99*, 418-425.

52. Gupta, A.; Rethwisch, D. G.; Bowden, N. B. "Retention of palladium and phosphine ligands using nanoporous polydicyclopentadiene membranes" *Chemical Communications*, **2011**, *46*, 10236-10238.

51. Yoo, J.; Runge, M. B.; Bowden, N. B. "Synthesis of complex architectures of comb block copolymers and their assembly in the solid state" *Polymers*, **2011**, *52*, 2499-2504.

50. Graf, T. A.; Anderson, T. K.; Bowden, N. B. "Extended lifetimes of gold(III) chloride catalysts using copper(II) chloride and 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO)" *Advanced Synthesis and Catalysis*, **2011**, *353*, 1033-1038.

49. Long, T. R.; Gupta, A.; Miler II, A. L.; Rethwisch, D. G.; Bowden, N. B. "Selective flux of organic liquids and solids using nanoporous membranes of polydicyclopentadiene" *J. Mater. Chem.* **2011**, *21*, 14265-14276.

**Note:** Invited article for a special issue Material Chemistry of Nanofabrication

48. Long, T. R.; Bowden, N. B. "PDMS thimbles" *Encyclopedia of Reagents for Organic Synthesis*, John Wiley & Sons Ltd., [http://onlinelibrary.wiley.com/o/eros/articles/rn01331/pdf\\_fs.html](http://onlinelibrary.wiley.com/o/eros/articles/rn01331/pdf_fs.html)[http://onlinelibrary.wiley.com/o/eros/articles/rn01331/pdf\\_fs.html](http://onlinelibrary.wiley.com/o/eros/articles/rn01331/pdf_fs.html); Posted online: September 15, 2011.

47. Byun, M.; Bowden, N. B.; Lin, Z. "Hierarchically ordered structures engineered from controlled evaporative self-assembly" *Nano Letters* **2010**, *51*, 368-369.

46. Perring, M.; Long, T. R.; Bowden, N. B. "Epoxidation of the surface of polydicyclopentadiene for the self-assembly of organic monolayers" *J. Mater. Chem.* **2010**, *20*, 8679-8685.

45. Byun, M.; Han, W.; Qui, F.; Bowden, N. B.; Lin, Z. "Hierarchically ordered structures enabled by controlled evaporative self-assembly" *Small* **2010**, *6*, 2250-2255.
44. Zhao, L.; Goodman, M. D.; Bowden, N. B.; Lin, Z. "Self-assembly of an ultra-high-molecular-weight comb block copolymer at the air-water interface" *Soft Matter* **2009**, *5*, 4698-4703.
43. Miller II, A. L.; Bowden, N. B. "Site-isolation and recycling of PdCl<sub>2</sub> using PDMS thimbles" *J. Org. Chem.* **2009**, *74*, 4834-4840.
42. Runge, M. B.; Yoo, J.; Bowden, N. B. "Synthesis of Comb Tri- and Tetrablock Copolymers Catalyzed by the Grubbs First Generation Catalyst" *Macromolecular Rapid Communications*, **2009**, *30*, 1392-1398.
41. Mwangi, M. T.; Schulz, M. D.; Ned B. Bowden "Cascade Reactions with Grubbs' Catalyst and AD-mix-a/b Using PDMS Thimbles" *Organic Letters*, **2009**, *11*, 33-36.
40. Perring, M.; Bowden, N. B. "Assembly of Organic Monolayers on Polydicyclopentadiene" *Langmuir*, **2008**, *24*, 10480-10487.
39. Miller II, A. L.; Bowden, N. B. "A Materials Approach to the Dual Site-Isolation of Catalysts Bonded to Linear Polymers and Small, Ionic Molecules for Use in One-Pot Cascade Reactions" *Advanced Materials*, **2008**, *20*, 4195-4199.
38. Runge, M. B.; Lipscomb, C. E.; Ditzler, L. R.; Mahanthappa, M. K.; Tivanski, A. V.; Bowden, N. B. "Investigation of the Assembly of Comb Block Copolymers in the Solid State" *Macromolecules*, **2008**, *41*, 7687-7694.
37. Mwangi, M. T.; Runge, M. B.; Hoak, K. M.; Schulz, M. D.; Bowden, N. B. "A Materials Approach to Site-Isolation of Grubbs' Catalysts from Incompatible Solvents and m-Chloroperoxybenzoic Acid" *Chem. Eur. J.* **2008**, *14*, 6780-6788.
36. Runge, M. B.; Mwangi, M. T.; Miller II, A. L.; Perring, M.; Bowden, N. B. "Cascade Reactions Using LiAlH<sub>4</sub> and Grignard Reagents in the Presence of Water" *Angew. Chem. Int. Ed.*, **2008**, *47*, 935-939.
35. Runge, M. B.; Bowden, N. B. "Synthesis of High Molecular Weight Comb Block Copolymers and Their Assembly into Ordered Morphologies in the Solid State" *J. Am. Chem. Soc.*, **2007**, *129*, 10551-10560.
34. Perring, M.; Mitchell, M.; Kenis, P. J. A.; Bowden, N. B. "Patterning by Etching at the Nanoscale (PENs) on Si(111) Through the Controlled Etching of PDMS" *Chemistry of Materials*, **2007**, *19*, 2903-2909.
33. Miller, A. L.; Bowden, N. B. "Room Temperature Ionic Liquids: New Solvents for Schrock's Catalyst and Removal Using Polydimethylsiloxane Membranes" *Chemical Communications*, **2007**, 2051-2053.
32. Runge, M. B.; Dutta, S.; Bowden, N. B. "Synthesis of Comb Block Copolymers by ROMP, ATRP, and ROP and Their Assembly in the Solid State" *Macromolecules*, **2006**, *39*, 498-508.
31. Dutta, S.; Perring, M.; Barrett, S.; Mitchell, M.; Kenis, P. J. A.; Bowden, N. B. "Cross Metathesis on Olefin-Terminated Monolayers on Si(111) Using the Grubbs' Catalyst" *Langmuir*, **2006**, *22*, 2146-2155.

30. Mwangi, M. T.; Runge, M. B.; Bowden, N. B. "Occlusion of Grubbs' Catalysts in Active Membranes of Polydimethylsiloxane. Catalysis in Water and New Functional Group Selectivities" *J. Am. Chem. Soc.*, **2006**, *128*, 14434-14435.
29. Runge, M. B.; Mwangi, M. T.; Bowden, N. B. "New Reactions from Old Catalysts. Occlusion of Grubbs' Catalysts in PDMS to Change Their Reactions" *J. Organomet. Chem*, **2006**, *691*, 5278-5288.
28. Gavranovic, G. T.; Csihony, S.; Bowden, N. B.; Hawker, C. J.; Waymouth, R. M.; Moerner, W. E.; Fuller, G. G. "Well-Controlled Living Polymerization of Perylene-Labeled Polyisoprenes and Their Use in Single Molecule Imaging" *Macromolecules*, **2006**, *39*, 8121-8127.
27. Arafat, S., Dutta, S.; Perring, M.; Mitchell, M.; Kenis, P. J. A.; Bowden, N. B. "Mild Methods to Assemble and Pattern Organic Monolayers on Hydrogen-Terminated Si(111)", *Chemical Communications*, **2005**, 3198-3200.
26. Perring, M.; Dutta, S.; Arafat, S.; Mitchell, M.; Kenis, P. J. A.; Bowden, N. B. "Simple Methods for the Direct Assembly, Functionalization, and Patterning of Acid-Terminated Monolayers on Si(111)", *Langmuir*, **2005**, *21*, 10537-10544.
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24. Wolfe, D. B.; Snead A.; Mao. C.; Bowden, N. B.; Whitesides, G. M. "Mesoscale Self-Assembly: Capillary Interactions When Positive and Negative Menisci Have Similar Amplitudes", *Langmuir* **2003** *19*, 2206-2214.
23. Bowden, N. B.; Dankova, M.; Wiyatno, W.; Waymouth, R. M., "Synthesis of Polyethylene Block Graft Copolymers from Styrene, Butyl Acrylate, and Butadiene", *Macromolecules* **2002** *35*, 9246-9248.
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19. Bowden, N.; Tien, J.; Huck, W. T. S.; Whitesides, G. M. *Mesoscale Self-Assembly: The Assembly of Micron- and Millimeter-Sized Objects Using Capillary Forces*; in "Supramolecular Organization and Materials Design", Jones, W. and Rao, C. N. R., Ed.; Cambridge University Press: Cambridge, **2002**, 103-145.
18. Oliver, S. R. J.; Clark, T. D.; Bowden, N.; Whitesides, G. M., "Three-Dimensional Self-Assembly of Complex, Millimeter-Scale Structures through Capillary Bonding", *J. Am. Chem. Soc.* **2001** *123*, 8119-8120.

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14. Oliver, S. R. J.; Bowden, N.; Whitesides, G. M., "Self-Assembly of Hexagonal Rods Based on Capillary Forces", *J. Colloid Interface Sci.* **2000** *224*, 425-428.
13. Huck, W. T. S.; Bowden, N.; Onck, P.; Pardoën, T.; Hutchinson, J. W.; Whitesides, G. M., "Ordering of Spontaneously Formed Buckles on Planar Surfaces", *Langmuir* **2000** *16*, 3497-3501.
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2. Kim, S.-H.; Zuercher, W. J.; Bowden, N. B.; Grubbs, R. H., "Catalytic Ring Closing Metathesis of Diynes: Construction of Fused Bicyclic [n.m.0] Rings", *J. Org. Chem.* **1996** *61*, 1073-1081.

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