

Jonathan C. Barnes, PhD

Academic Position

Assistant Professor (July 2016 – present) - *Washington University in St Louis*
Department of Chemistry, One Brookings Drive, St. Louis, MO 63130-4899
E-mail: jbarnes@wustl.edu / Phone: 314-935-7921 / Website: www.jbarneslab.com

Education/Training

Postdoctoral Fellow

Howard Hughes Medical Institute Fellow
Life Sciences Research Foundation
Department of Chemistry
Massachusetts Institute of Technology
Cambridge, MA
Advisor – Prof. Jeremiah A. Johnson
Feb 2014 – June 2016

Master of Science – Chemistry

University of Kentucky
Lexington, Kentucky
Advisor – Prof. Robert B. Grossman
Jan 2005 – Dec 2006

PhD in Organic Chemistry

Department of Defense NDSEG Fellow
International Institute of Nanotechnology Ryan Fellow
Department of Chemistry
Northwestern University
Evanston, IL
Advisor – Prof. Fraser Stoddart (**2016 Nobel Laureate**)
Sep 2010 – Feb 2014

Bachelor of Science – Chemistry

University of Kentucky
Summa Cum Laude
Advisor – Prof. Robert B. Grossman
Aug 2000 – Dec 2004

Industrial Experience

Synedgen, Inc.: Research Scientist / Chemical Hygiene Officer / Chemical Inventory Manager
President: Dr. Shenda Baker; Claremont, CA; Feb 2007 – June 2010

Research Experience

Polymers, Drug Delivery, Actuators, & Materials

Washington University in St. Louis
St. Louis, MO
Position Title – Assistant Professor

Interdisciplinary research focused on developing new redox-responsive polymers and stimuli-responsive actuator materials, new polymer architectures, and combination drug-loaded nanotherapeutics

Synthetic Polymer Methodology & Drug Delivery

Massachusetts Institute of Technology
Cambridge, MA,
Postdoctoral Advisor – Prof. Jeremiah Johnson

Interdisciplinary research on topics including controlled step-growth polymerization methodology, synthesis of bivalent macromonomers, and *in vivo* efficacy studies of 3-drug-loaded polymer nanoparticles

Supramolecular Chemistry & Nanotechnology

Northwestern University
Evanston, IL
Graduate Advisor – Prof. Fraser Stoddart

Dissertation Title: ‘Expanding the Role of Viologens in Supramolecular Chemistry through Radical-Based Integrated Materials and as Hosts for Polycyclic Aromatic Hydrocarbons.’

Synthesis of Antimicrobial Biopolymers

Synedgen, Inc.
Claremont, CA
President – Dr. Shenda Baker

Developed a library of amino-acid functionalized chitosan biopolymers for antimicrobial applications. Assessed ability of biopolymers to clot porcine blood using a hemostatic analyzer and in gelatin molds.

Design & Synthesis of Peptide-based Inhibitors

University of Kentucky
Lexington, KY
BS/MS Advisor – Prof. Robert Grossman

Thesis Title: ‘Peptide Deformylase: A Modeling Study of the Active Sites of Plants and Bacteria and the Design, Synthesis, and Biological Activity Analysis of Peptide-based Inhibitors.’

Awards and Fellowships

2020 ACS PMSE Young Investigator
2020 *Polymer Chemistry*, Emerging Investigator
2019 *Supramolecular Chemistry*, Emerging Supramolecular Chemist in the United States
2019 Kavli Fellow (Kavli Foundation / U.S. National Academy of Sciences)
2017 Young Investigator Award (Cancer Research Foundation)
2017 Packard Fellowship for Science and Engineering (Packard Foundation)
2017 Foresight Fellow – Synthetic Polymer Chemistry (Foresight Institute)
2015 IUPAC-SOLVAY International Award for Young Chemists
2015 Northwestern Department of Chemistry Award for Excellence in Graduate Research
2014 Howard Hughes Medical Institute Postdoctoral Fellow of the Life Sciences Research Foundation
2013 Foresight Institute Distinguished Student Award Winner
2013 Department of Energy Innovations in Fuel Cycle Research Award
2012 Northwestern International Institute for Nanotechnology Ryan Fellowship
2012 Department of Defense National Defense Science & Engineering Graduate Fellowship
2011 World Class University Fellowship – NanoCentury KAIST Institute / Korea
2001 Thomas B. Nantz Memorial Scholarship (Excellence in Chemistry), University of Kentucky

Publications

Independent (at WUSTL)

Submitted//Under Review:

- 43) Amir, F.; Gruschka, M.; Colley, N. D.; Li, L.; Linder, H. R.; Sell, S. A.; **Barnes, J. C.*** Dual-Responsive Dynamic Hydrogels Using Porphyrin-based Photoredox Catalysis and Thermoresponsive Polymers. *Submitted*.
- 42) Delawder, A. O.; **Barnes, J. C.*** Precise patterning driven by droplets. *Nature Chem. N&Vs. 2020, Submitted*.
- 41) Colley, N. D.; Nosiglia, M. A.; Li, L.; Amir, F.; Chang, C.; Fisher, J. A.; **Barnes, J. C.*** One-Pot Synthesis of a Linear [4]Catenate Using Orthogonal Metal Templation and Ring-Closing Metathesis. *Under Review*.

Published:

- 40) Li, R.; Li, X.; Zhang, Y.; Delawder, A. O.; Colley, N. D.; Whiting, E.; **Barnes, J. C.*** Diblock Brush-Arm Star Copolymers via a Core-First/Graft-From Approach Using γ -Cyclodextrin and ROMP: A Modular Platform for Drug Delivery. *Polym. Chem. 2020, 11, 541–550. Part of the 'Polymer Chemistry Emerging Investigators 2020' issue*.
- 39) Delawder, A. O.; Natraj, A.; Colley, N. D.; Saak, T.; Greene, A. F.; **Barnes, J. C.*** Synthesis, Self-Assembly, and Photomechanical Actuator Performance of a Sequence-Defined Polyviologen Macrocrosslinker. *Supramol. Chem. 2019, 31, 523–531. Part of the 'Emerging Supramolecular Chemists in the United States' special issue*.
- 38) Amir, F.; Liles, K. P.; Delawder, A. O.; Colley, N. D.; Palmquist, M. S.; Linder, H. R.; Sell, S. A.; **Barnes, J. C.*** Reversible Hydrogel Photopatterning: Spatial and Temporal Control Over Gel Mechanical Properties Using Visible-Light Photoredox Catalysis. *ACS Appl. Mater. Interfaces 2019, 11, 24627–24638*.
- 37) Liles, K. P.; Greene, A. F.; Danielson, M. K.; Colley, N. D.; Wellen, A.; Fisher, J. A.; **Barnes, J. C.*** Photoredox-based Actuation of an Artificial Molecular Muscle. *Macromol. Rapid Commun. 2018, 1700781*.
- 36) Greene, A. F.; Danielson, M.; Liles, K. P.; Delawder, A. O.; Li, X.; Natraj, A.; Wellen, A.; **Barnes, J. C.*** Redox-Responsive Artificial Molecular Muscles: Reversible Radical-Based Self-Assembly for Actuating Hydrogels. *Chem. Mater. 2017, 29, 9498–9508*.
- 35) **Barnes, J. C.***; Mirkin, C. A.* Profile of Jean-Pierre Sauvage, Sir J. Fraser Stoddart, and Bernard L. Feringa, 2016 Nobel Laureates in Chemistry. *Proc. Natl. Acad. Sci. 2017, 114, 620–625*.

Postdoctoral (at MIT)

- 34) **Barnes, J. C.**; Bruno, P.; Nguyen, H. V.-T.; Liao, L.; Liu, J.; Hemann, M. T.; Johnson, J. A. Using an RNAi Signature Assay to Guide the Design of Three-Drug Conjugated Nanoparticles with Validated Mechanisms, *In Vivo* Efficacy, and Low Toxicity. *J. Am. Chem. Soc.* **2016**, *138*, 12494–12501.
- 33) Jiang, Y.; Golder, M. R.; Nguyen, H. V.-T.; Wang, Y.; Zhong, M.; **Barnes, J. C.**; Ehrlich, D. J.; Johnson, J. A. IEG Synthesis and Assembly of Uniform Diblock Copolymers. *J. Am. Chem. Soc.* **2016**, *138*, 9369–9372.
- 32) **Barnes, J. C.**; Ehrlich, D. J.; Gao, A. X.; Leibfarth, F. A.; Jiang, Y.; Zhou, E.; Jamison, T. F.; Johnson, J. A. Iterative Exponential Growth of Stereo- and Sequence-Controlled Polymers. *Nature Chem.* **2015**, *7*, 810–815. **Highlighted in RSC's Chemistry World.**

Graduate (at UK and NU)

- 31) Sun, J.; Liu, Z.; Liu, W.-G.; Wu, Y.; Wang, Y.; **Barnes, J. C.**; Hermann, K. R.; Goddard, W. A., III; Wasielewski, M. R.; Stoddart, J. F. Mechanical Bond-Protected, Air-Stable Radicals. *J. Am. Chem. Soc.* **2017**, *139*, 12704–12709.
- 30) Cheng, C.; Cheng, T.; Xiao, H.; Krzyaniak, M. D.; Wang, Y.; McGonigal, P. R.; Frasconi, M.; **Barnes, J. C.**; Fahrenbach, A. C.; Wasielewski, M. R.; Goddard, W. A., III; Stoddart, J. F. Influence of Constitution and Charge on Radical Pairing Interactions in Trisradical Tricationic Complexes. *J. Am. Chem. Soc.* **2016**, *138*, 8288–8300.
- 29) Dale, E. J.; Ferris, D. P.; Vermeulen, N. A.; Henkelis, J. J.; Popovs, I.; Juriček, M.; **Barnes, J. C.**; Schneebeli, S. T.; Stoddart, J. F. Cooperative Reactivity in an Extended-Viologen-Based Cyclophane. *J. Am. Chem. Soc.* **2016**, *138*, 3667–3670.
- 28) Dale, E. J.; Vermeulen, N. A.; Juriček, M.; **Barnes, J. C.**; Young, R. M.; Wasielewski, M. R.; Stoddart, J. F. Supramolecular Explorations: Exhibiting the Extent of Extended Cationic Cyclophanes. *Acc. Chem. Res.* **2016**, *49*, 262–273.
- 27) Gibbs-Hall, I. C.; Vermeulen, N. A.; Dale, E. J.; Henkelis, J. J.; Blackburn, A. K.; **Barnes, J. C.**; Stoddart, J. F. Catenation through a Combination of Radical Templation and Ring-Closing Metathesis. *J. Am. Chem. Soc.* **2015**, *137*, 15640–15643.
- 26) **Barnes, J. C.**; Dale, E. J.; Prokofjevs, A.; Narayanan, A.; Gibbs-Hall, I. C.; Juriček, M.; Stern, C. L.; Sarjeant, A. A.; Botros, Y. Y.; Stupp, S. I.; Stoddart, J. F. Semiconducting Single Crystals Comprising Segregated Arrays of Complexes of C₆₀. *J. Am. Chem. Soc.* **2015**, *137*, 2392–2399.
- 25) Sun, J.; Frasconi, M.; Liu, Z.; **Barnes, J. C.**; Wang, Y.; Chen, D.; Stern, C. L.; Stoddart, J. F. Formation of Ring-in-Ring Complexes Between Crown Ethers and Rigid TVBox⁸⁺. *Chem. Commun.* **2015**, *51*, 1432–1435.
- 24) Fathalla, M.; **Barnes, J. C.**; Young, R. M.; Hartlieb, K. J.; Dyar, S. M.; Eaton, S. W.; Sarjeant, A. A.; Co, D. T.; Wasielewski, M. R.; Stoddart, J. F. Photoinduced Electron Transfer within a Zinc Porphyrin–Cyclobis(paraquat-*p*-phenylene) Donor–Acceptor Dyad. *Chem. Eur. J.* **2014**, *20*, 14690–14697.
- 23) **Barnes, J. C.**; Frasconi, M.; Young, R. M.; Khadry, N. H.; Liu, W.-G.; Dyar, S. M.; McGonigal, P. R.; Gibbs-Hall, I. C.; Diercks, C. S.; Sarjeant, A. A.; Stern, C. L.; Goddard, W. A., III; Wasielewski, M. R.; Stoddart, J. F. Solid-State Characterization and Photoinduced Intramolecular Electron Transfer in a Nanoconfined Octacationic Homo[2]Catenane. *J. Am. Chem. Soc.* **2014**, *136*, 10569–10572.
- 22) Dale, E. J.; Vermeulen, N. A.; Thomas, A. A.; **Barnes, J. C.**; Juriček, M.; Blackburn, A. K.; Strutt, N. L.; Sarjeant, A. A.; Stern, C. L.; Denmark, S. E.; Stoddart, J. F. ExCage. *J. Am. Chem. Soc.* **2014**, *136*, 10669–10682.
- 21) Witus, L. S.; Hartlieb, K. J.; Wang, Y.; Prokofjevs, A.; Frasconi, M.; **Barnes, J. C.**; Dale, E. J.; Fahrenbach, A. C.; Stoddart, J. F. Relative Contractile Motion of the Rings in a Switchable Palindromic [3]Rotaxane in Aqueous Solution Driven by Radical-Pairing Interactions. *Org. Biomol. Chem.* **2014**, *12*, 6089–6093.
- 20) Juriček, M.[†]; **Barnes, J. C.**[†]; Strutt, N. L.[†]; Vermeulen, N. A.; Ghooray, K. C.; Dale, E. J.; McGonigal, P. R.; Blackburn, A. K.; Avestro, A.-J.; Stoddart, J. F. An ExBox [2]Catenane. *Chem. Sci.* **2014**, *5*, 2724–2731.
[†]Authors contributed equally

- 19) Dyar, S. M.; **Barnes, J. C.**; Juriček, M.; Stoddart, J. F.; Co, D. T.; Young, R. M.; Wasielewski, M. R. Electron Transfer and Multi-Electron Accumulation in ExBox⁴⁺. *Angew. Chem. Int. Ed.* **2014**, *53*, 5371–5375.
- 18) Fathalla, M.; Strutt, N. L.; **Barnes, J. C.**; Stern, C. L.; Ke, C.; Stoddart, J. F. Fluorescence Enhancement of a Porphyrin-Viologen Dyad via Pseudorotaxane Formation with Cucurbit[7]uril. *Eur. J. Org. Chem.* **2014**, 2873–2877. *Front Cover Article.*
- 17) Tarn, D.; Ferris, D.; **Barnes, J. C.**; Ambrogio, M. W.; Stoddart, J. F., Zink, J. I. A Reversible, Light-Operated Nanovalve on Mesoporous Silica Nanoparticles. *Nanoscale* **2014**, *6*, 3335–3343.
- 16) Juriček, M.; Strutt, N. L.; **Barnes, J. C.**; Butterfield, A. M.; Dale, E. J.; Baldrige, K. K.; Stoddart, J. F.; Siegel, J. S. Induced-Fit Catalysis of Corannulene Bowl-to-Bowl Inversion. *Nature Chem.* **2014**, *6*, 222–228.
- 15) Kung, C.-W.; Wang, T. C.; Mondloch, J. E.; Fairen-Jimenez, D.; Gardner, D. M.; Bury, W.; Klingsporn, J. M. **Barnes, J. C.**; Van Duyne, R.; Stoddart, J. F.; Wasielewski, M. R.; Farha*, O. K.; Hupp, J. T. Metal–Organic Framework Thin Films Composed of Free-Standing Acicular Nanorods Exhibiting Reversible Electrochromism. *Chem. Mater.* **2013**, *25*, 5012–5017.
- 14) **Barnes, J. C.**; Juriček, M.; Vermeulen, N. A.; Dale, E. J.; Stoddart, J. F. Synthesis of ExⁿBox Cyclophanes. *J. Org. Chem.* **2013**, *78*, 11962–11969.
- 13) Young, R. M.; Dyar, S. M.; **Barnes, J. C.**; Juriček, M.; Stoddart, J. F.; Co, D. T.; Wasielewski, M. R. Ultrafast Conformational Dynamics of Electron Transfer in ExBox⁴⁺⊂Perylene. *J. Phys. Chem. A* **2013**, *117*, 12438–12448.
- 12) Juriček, M. †; **Barnes, J. C.** †; Dale, E. J.; Liu, W.-G.; Strutt, N. L.; Bruns, C. J.; Vermeulen, N. A.; Ghooray, K.; Sarjeant, A. A.; Stern, C. L.; Botros, Y. Y.; Goddard, W. A., III; Stoddart, J. F. Ex²Box: Interdependent Modes of Binding in a Two-Nanometer-Long Synthetic Receptor. *J. Am. Chem. Soc.* **2013**, *135*, 12736–12746. †These authors contributed equally.
- 11) **Barnes, J. C.**; Fahrenbach, A. C.; Cao, D.; Dyar, S. M.; Frasconi, M.; Giesener, M. A.; Benítez, D.; Tkatchouk, E.; Chernyashevskyy, O.; Shin, W. H.; Li, H.; Sampath, S.; Stern, C. L.; Sarjeant, A. A.; Hartlieb, K. J.; Liu, Z.; Carmieli, R.; Botros, Y. Y.; Choi, J. W.; Slawin, A. M. Z.; Ketterson, J. B.; Wasielewski, M. R.; Goddard, W. A., III; Stoddart, J. F. A Radically Configurable Six-State Compound. *Science* **2013**, *339*, 429–433. *Highlighted in C&EN ‘News of the Week’, RSC’s Chemistry World, Nature Middle East, and Nature Chemistry’s News and Views.*
- 10) Li, H.; Zhu, Z.; Fahrenbach, A. C.; Savoie, B. M.; Ke, C.; **Barnes, J. C.**; Lei, J.; Zhao, Y.-L.; Lilley, L. M.; Marks, T. J.; Ratner, M. A.; Stoddart, J. F. Mechanical Bond-Induced Radical Stabilization. *J. Am. Chem. Soc.* **2013**, *135*, 456–467.
- 9) **Barnes, J. C.**; Juriček, M.; Strutt, N. L.; Frasconi, M.; Sampath, S.; Giesener, M. A.; McGrier, P. L.; Bruns, C. J.; Stern, C. L.; Sarjeant, A. A.; Stoddart, J. F. ExBox: A Polycyclic Aromatic Hydrocarbon Scavenger. *J. Am. Chem. Soc.* **2013**, *135*, 183–192. *Front Cover Article. Highlighted in C&EN and RSC’s Chemistry World.*
- 8) Fahrenbach, A. C.; Warren, S. C.; Incorvati, J. T.; Avestro, A.-J.; **Barnes, J. C.**; Stoddart, J. F.; Grzybowski, B. A. Organic Switches for Surfaces and Devices. *Adv. Mater.* **2013**, *3*, 331–348.
- 7) Fahrenbach, A. C.; Sampath, S.; Late, D. J.; **Barnes, J. C.**; Kleinman, S. L.; Valley, N.; Hartlieb, K. J.; Liu, Z.; Dravid, V. P.; Schatz, G. C.; Van Duyne, R. P.; Stoddart, J. F. A Semiconducting Organic Radical Cationic Host–Guest Complex. *ACS Nano* **2012**, *6*, 9964–9971.
- 6) Zhu, Z.; Fahrenbach, A. C.; Hao, L.; **Barnes, J. C.**; Liu, Z.; Dyar, S. M.; Zhang, H.; Lei, J.; Carmieli, R.; Sarjeant, A. A.; Stern, C. L.; Wasielewski, M. R.; Stoddart, J. F. Controlling Switching in Bistable [2]Catenanes by Combining Donor-Acceptor and Radical-Radical Interactions. *J. Am. Chem. Soc.* **2012**, *134*, 11709–11720.
- 5) **Barnes, J. C.**; Fahrenbach, A. C.; Dyar, S. M.; Frasconi, M.; Giesener, M. A.; Zhu, Z.; Liu, Z.; Hartlieb, K. J.; Carmieli, R.; Wasielewski, M. R.; Stoddart, J. F. Mechanically-Induced Intramolecular Electron Transfer in a Mixed-Valence Molecular Shuttle. *Proc. Natl. Acad. Sci.* **2012**, *109*, 11546–11551. *Front Cover Article.*
- 4) Fahrenbach, A. C.; **Barnes, J. C.**; Lanfranchi, D. A.; Li, H.; Coskun, A.; Gassensmith, J. J.; Liu, Z.; Benítez, D.; Trabolsi, A.; Goddard, W. A., III; Elhabiri, M.; Stoddart, J. F. Solution-Phase Mechanistic Study and

- Solid-State Structure of a Tris(Bipyridinium Radical Cation) Inclusion Complex. *J. Am. Chem. Soc.* **2012**, *134*, 3061–3072.
- 3) Li, Z.; **Barnes, J. C.**; Bosoy, A.; Stoddart, J. F.; Zink, J. I. Mesoporous Silica Nanoparticles for Biomedical Applications. *Chem. Soc. Rev.* **2012**, *41*, 2590–2605.
 - 2) Fahrenbach, A. C.; **Barnes, J. C.**, Li, H.; Benítez, D.; Basuray, A. N.; Fang, L.; Sue, C. H.; Barin, G.; Dey, S. K.; Goddard, W. A., III; Stoddart, J. F. Direct Measurement of the Ground-State Distributions in Bistable Donor-Acceptor Mechanically Interlocked Molecules Using Slow Scan Rate Cyclic Voltammetry. *Proc. Natl. Acad. Sci.* **2011**, *108*, 20416–20421.
 - 1) Dirk, L. M. A.; Schmidt, J. J.; Cai, Y.; **Barnes, J. C.**; Hanger, K. M.; Nayak, N. R.; Williams, M. A.; Grossman, R. B.; Houtz, R. L.; Rodgers, D. W. Insights into the Substrate Specificity of Plant Peptide Deformylase, an Essential Enzyme with Potential for the Development of Novel Biotechnology Applications in Agriculture. *Biochem. J.* **2008**, *413*, 417–427.
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Patent Information

- 7) **Barnes, J. C.**; Li, X.; Delawder, A. O.; Li, R. U.S. Patent Application 16/370,316. Compositions of Drug Delivery Agents and Methods of Use Thereof. Filed: March 29, **2019**.
 - 6) **Barnes, J. C.**; Greene, A. F.; Delawder, A. O.; Liles, K. P. U.S. Patent Application 15/939,515. Actuating Materials and Method of Making and Using the Same. Filed: March 29, **2018**.
 - 5) Johnson, J. A.; Longyan, L.; **Barnes, J. C.** U.S. Patent Application 15/616,498. Drug Delivery Polymers and Uses Thereof. Filed: December 7, **2017**.
 - 4) Johnson, J. A.; **Barnes, J. C.**; Ehrlich, D. J. C.; Jiang, Y.; Gao, A. X. U.S. Patent Application 15/074,779. Formation of Macromolecules Using Iterative Growth and Related Compounds. Filed: June 6, **2016**.
 - 3) Stoddart, J. F.; **Barnes, J. C.**; Juricek, M. U.S. Patent 9,290,495. Tetracationic Cyclophanes and Their Use in the Sequestration of Polyaromatic Hydrocarbons by Way of Complexation. Published: March 22, **2016**.
 - 2) Stoddart, J. F.; Dale, E. J.; Vermeulen, N. A.; **Barnes, J. C.**; Juricek, M. U.S. Patent 9,828,259. ExCage: Synthesis of Viologen-Like Pyridinium-Based Cages for the Selective Capture of Polycyclic Aromatic Hydrocarbons. Filed: November 28, **2017**.
 - 1) Stoddart, J. F.; Fahrenbach, A. C.; **Barnes, J. C.**; Li, H.; Sampath, S.; Basuray, A. U.S. Patent 9,120,799. Crystalline Bipyridinium Radical Complexes and Uses Thereof. Published: September 1, **2015**.
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Professional Memberships

University of Kentucky Chemistry Department Advisory Board	<i>October 2018 – Present</i>
WUSTL Siteman Cancer Center Faculty Member	<i>February 2018 – Present</i>
Member of the American Chemical Society (ACS)	<i>January 2006 – Present</i>
Member of the Materials Research Society (MRS)	<i>July 2015 – Present</i>
Member of the Royal Society of Chemistry (RSC)	<i>July 2015 – Present</i>
Northwestern University Chemistry Department Alumni Advisory Board	<i>August 2015 – 2016</i>

Teaching Experience

Lecturing at WUSTL:

Chemistry 261: Organic Chemistry I with Lab (Fall 2018): 248 students

- The first part of a two-semester survey of organic chemistry lecture and lab. The course includes an introduction to organic structures, reactions, and reaction mechanisms. The laboratory is an introduction to methods in organic chemistry including separation and methods of purification of organic compounds.

Chemistry 452L: Synthetic Polymer Chemistry with Lab (Spring 2020): 16-18 students (9 when lab added)

- CHE 452L is an upper-level undergraduate and graduate level course that describes various methods for the synthesis and characterization of polymers. Copolymers, control of architecture, sequence, polymer reactivity, polymer properties, structure/property relationships, and applications of polymers are discussed. Current topics of interest from the recent literature are also covered. The learning objective should be that students are familiar with a variety of polymerization techniques – both in terms of mechanism and protocol – and they are able to design specific monomers in order to develop novel polymeric materials with precise architectures, molecular weights, and function.
- Beginning in spring 2020, I created a new laboratory component to go along with the lecture course, which raised it to a four-credit hour course. In the lab, students do four standard labs on step-growth, ring-opening, anionic, and atom transfer radical polymerizations to gain basic skills in making and characterizing polymers. These standard labs are then followed by independent projects in which I collaborate with the students as they pursue projects that they create, which build on already published works. In taking this lab, the students will gain first-hand knowledge of polymer synthesis and characterization (NMR and GPC), as well as several other techniques like dynamic light scattering, rheology, etc

Mentoring at WUSTL:

Postdoctoral Associates in the Barnes Group:

- **Angelique F. Greene** (PhD from Tulane University, U.S.): **8/1/2016 – 10/15/2018**
- **Xuesong Li** (PhD from the University of Bordeaux, France): **9/12/2016 – Present**
- **Faheem Solangi** (PhD from University of Queensland, Australia): **04/16/2018 – Present**
- **Lei Li** (PhD from University of Florida, U.S.): **02/04/2019 – Present**

Graduate Students in the Barnes Group:

- **Abigail Delawder** (4th Year, NSF GRFP): **12/15/2016 – Present**
- **Nathan Colley** (4th Year): **12/15/2016 – Present**
- **Kevin Liles** (Master's): **12/15/2016 – 4/12/2019**
- **Mark Nosiglia** (3rd Year): **12/15/2017 – Present**
- **Ruihan Li** (3rd Year): **12/15/2017 – Present**
- **Mary Danielson** (2nd Year): **12/15/2018 – Present**
- **Mark Palmquist** (2nd Year): **12/15/2018 – Present**
- **Yipei Zhang** (2nd Year): **12/15/2018 – Present**
- **Jovelt Dorsainvil** (1st Year): **12/15/2019 – Present**
- **Sheila Tran** (1st Year): **12/15/2019 – Present**
- **Gray Harlan** (1st Year): **12/15/2019 – Present**

Seminars/Presentations

Invited Seminars While at WUSTL:

March 11, 2021

Invited Seminar at **Texas A&M University**, College Station, TX

Title: TBD

March 10, 2021

Invited Seminar at **Rice University**, Houston, TX

Title: TBD

March 9, 2021

Invited Seminar at the **University of Houston**, Houston, TX

Title: TBD

December 15-20, 2020

Invited Seminar at **Pacificchem 2020**, Honolulu, HI

Title: Precision Polyviologens: Synthesis, Self-Assembly, and Performance in Polymer Networks

November 3, 2020

Invited Seminar at the **University of Texas at Austin**, Austin, TX

Title: TBD

October 13, 2020

Invited Seminar at **Indiana University**, Bloomington, IN

Title: TBD

October 7, 2020

Invited Seminar at **The Ohio State University**, Columbus, OH

Title: TBD

May 27–30, 2020

Invited Seminar at the **ACS Central Regional Meeting**, Dayton, OH

Title: TBD

March 22–26, 2020

Invited Seminar at the **ACS National Meeting – Division of Polymer Chemistry**, Philadelphia, PA

Title: Next-Generation Stimuli-Responsive Materials Using Sequence-Defined Redox-Responsive Polymers

March 12, 2020

Invited Seminar at **University of Tulsa**, Tulsa, OK

Title: TBD

November 5, 2019

Invited Seminar at **Brigham Young University**, Provo, UT

Title: Functional Supramolecular Polymers and Crosslinkers to Control Structure, Properties, and Performance in Polymer Networks and Nanomaterials

October 16–18, 2019

Invited Seminar at the **ACS Midwest Regional Meeting – Midwest Award Symposium**, Wichita, KS

Title: Application of Visible-Light Photoredox Catalysis in Polymer Networks to Control Movement and Mechanical Properties of Gels

September 15–18, 2019

Invited Flash Presentation at **Kavli Frontiers of Science Symposium**, Jerusalem, Israel

Title: Functional Supramolecular Polymers and Crosslinkers to Control Structure, Properties, and Performance in Polymer Networks and Nanomaterials

June 1–6, 2019

Invited Flash Presentation at the **International Symposium on Macrocyclic and Supramolecular Chemistry**, Lecce, Italy

Title: Sequence-Defined Viologen Polymers for Controlling Movement and Mechanical Properties in Gels

May 16, 2019

Invited Seminar at **Dartmouth College**, Hanover, NH

Title: Sequence-Defined Redox-Responsive Polymers as Artificial Molecular Muscles

April 26–27, 2019

Invited Seminar at the **Foresight Institute Workshop**, Palo Alto, CA

Title: Healing the Planet: Atomic Precision for Clean Energy and Air

November 5, 2018

Invited Seminar at **University of Missouri-St. Louis**, St. Louis, MO

Title: Redox-responsive Radical Polymers as Artificial Molecular Muscles in Soft Actuators

September 19, 2018

Invited Seminar at **Missouri State University**, Springfield, MO

Title: Exploring Radical Molecules, Materials, and Artificial Molecular Muscles

September 5–8, 2018

Invited Seminar at the **30th Annual Packard Foundation Fellows Meeting**, San Diego, CA

Title: Radical Polymers as Artificial Molecular Muscles

May 5–6, 2018

Co-organizer and Invited Seminar at the **Foresight Institute Workshop** with **Fraser Stoddart**, Washington University, St. Louis, MO

Title: Integrated Molecular Machines: From Materials to Nanosystems

April 27, 2018

Invited Seminar at **Western Kentucky University**, Bowling Green, KY

Title: Radical Molecular Recognition in Mechanically Interlocked Molecules & Artificial Molecular Muscles

April 16–19, 2018

Invited Seminar at the **Foundations of Nanoscience Conference**, Snowbird, UT

Title: Redox-responsive Artificial Molecular Muscles

March 1, 2018

Invited Seminar at **Tianjin University**, Tianjin, China

Title: Redox-responsive Artificial Molecular Muscles

June 28, 2017

Invited Seminar at **Nottingham University**, Nottingham, England

Title: Redox-responsive Artificial Molecular Muscles: Reversible Radical-based Self-assembly for Actuating 3D Soft Materials

May 5, 2017

Invited Seminar at **Truman State University**, Kirksville, MO

Title: The Importance of Fundamental Chemical Research: An Exploration into Molecular Machines, Materials, and Drug Delivery

April 12-13, 2017

Invited Keynote Speaker, Student Research Conference **Southeast Missouri State University**, Cape Girardeau, MO

Title: The Importance of Fundamental Chemical Research: An Exploration into Molecular Machines, Materials, and Drug Delivery

April 12, 2017

Invited Seminar at local **ACS Southern Illinois Section Meeting**, Cape Girardeau, MO

Title: Developing Functional Macromolecular Platforms for Stimuli-responsive Materials and Combination Therapeutics

April 2 – 6, 2017

Invited Seminar at the **ACS National Meeting – Division of Polymer Chemistry**, San Francisco, CA

Title: Multi-stimuli Responsive Viologels: Reversible Reorganization of a 3D Polymer Network via Radical-based Self Assembly

March 30, 2017

Invited Seminar at **Monsanto Company**, St. Louis, MO

Title: Multi-stimuli Responsive Viologels: Reversible Reorganization of a 3D Polymer Network via Radical-based Self Assembly

December 6–10, 2016

Invited Seminar at Symposium in Honor of Fraser Stoddart co-Winning the **2016 Nobel Prize (Chemistry)**, Stockholm, Sweden

Title: Radical Musings of a Nobel Laureate

Contributed Seminars While at WUSTL:

August 25–29, 2019

Two Oral Presentations at the **ACS National Meeting – Polymeric Materials: Science and Engineering Division**, San Diego, CA

Titles: Self-Assembled Supramolecular Polymers for Next-Generation Nanoparticle-based Combination Drug Delivery / Spatiotemporal Control of Hydrogel Mechanical Properties Through Visible-Light Activation of Viologen-based Macrocrosslinkers

March 31–April 4, 2019

Two Oral Presentations at the **ACS National Meeting – Division of Polymer Chemistry**, Orlando, FL
Titles: Supramolecular Polymer-based Nanomaterials as a Universal Combination Drug Delivery Strategy / Sequence-Defined Redox-Responsive Polymers as Artificial Molecular Muscles

April 2–6, 2018

Oral Presentation at the **MRS National Meeting – Soft Materials and Biomaterials**, Phoenix, AZ
Title: Redox-responsive Soft Actuators

March 18–22, 2018

Two Oral Presentations at the **ACS National Meeting – Division of Polymer Chemistry**, New Orleans, LA
Title: Supramacromolecular Strategy to Combat Multidrug-Resistant Bacteria / Redox-responsive Artificial Molecular Muscles

June 11–16, 2017

Poster Presentation at **Gordon Research Conference - Polymers**, South Hadley, MA
Title: Redox-responsive Artificial Molecular Muscles: Reversible Radical-based Self-assembly for Actuating 3D Soft Materials

Poster Presentations While at WUSTL:

September 4–7, 2019

Poster Presentation at the **30th Annual Packard Foundation Fellows Meeting**, San Diego, CA
Title: Functional Supramolecular Polymers and Crosslinkers to Control Structure, Properties, and Performance in Polymer Networks and Nanomaterials

September 15–18, 2019

Poster Presentation at **Kavli Frontiers of Science Symposium**, Jerusalem, Israel
Title: Functional Supramolecular Polymers and Crosslinkers to Control Structure, Properties, and Performance in Polymer Networks and Nanomaterials

June 8–14, 2019

Poster Presentation at **Gordon Research Conference – Polymers**, South Hadley, MA
Title: Supramolecular Polymers and Crosslinkers to Control Structure, Properties, and Performance in Polymer Networks and Nanomaterials

Workshops/Conferences Attended Without Presenting

While at WUSTL:

September 16–17, 2017

Attended the **Foresight Institute**'s Workshop in Palo Alto, CA
Title: Atomic Precision for Longevity and Healthspan

August 20–24, 2017

ACS National Meeting, Washington, DC

May 27–18, 2017

Attended the **Foresight Institute**'s Workshop in Palo Alto, CA
Title: AI for Atomic Precision: Design Software for Molecular Machines

My Group's Research in the News

October 10, 2019

WUSTL News Article: Department of Chemistry, WashU
<https://chemistry.wustl.edu/news/new-photo-responsive-hydrogels-developed-eye-biomedical-applications>

April 2, 2019

ACS News Release: ACS National Meeting in Orlando, FL
<https://www.acs.org/content/acs/en/pressroom/newsreleases/2019/april/muscle-like-material-expands-and-contracts-in-response-to-light-video.html>

January 30, 2019

CDI Grant Announcement/Story: WashU Medical School – Division of Nephrology
<https://nephrology.wustl.edu/drs-jeffrey-miner-and-jonathan-barnes-receive-childrens-discovery-institute-grant/>

September 01, 2018

Cancer Research Foundation Podcast: ‘Fighting Cancer Podcast – Episode 001.’
<https://www.cancerresearchfdn.org/recipient/jonathan-barnes/?back=young-investigator-awards>

February 17, 2018

Advanced Science News: ‘Artificial Muscle is Light-Triggered, Redox-Actuated’ written by Lisa Smith.
<https://www.advancedsciencenews.com/artificial-muscle-light-triggered-redox-actuated/>

January 26, 2018

theSource, Washington University in St. Louis: ‘New molecular muscle responds to visible light’ written by Talia Ogliore. <https://source.wustl.edu/2018/01/new-molecular-muscle-responds-visible-light/>

November 8, 2017

Cancer Research Foundation: ‘2017 Young Investigator Awards’ announcement.
<https://www.cancerresearchfdn.org/program/young-investigator-awards/>

October 16, 2017

The David and Lucille Packard Foundation: ‘2017 Packard Fellowships for Science and Engineering’ announcement. <https://www.packard.org/2017/10/2540916/>

March 13, 2017

Foresight Institute: ‘2017 Foresight Fellows’ announcement.
<http://www.prweb.com/releases/2017/03/prweb14142965.htm#!>