

Carson J. Bruns

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ATLAS Institute / Department of Mechanical Engineering
University of Colorado, Boulder
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Education

- | | | |
|---|--------------------------------|---------------|
| • Doctor of Philosophy
Organic Chemistry | <i>Northwestern University</i> | December 2013 |
| • Bachelor of Arts <i>magna cum laude</i>
Chemistry, Religion, Mathematics (minor) | <i>Luther College</i> | May 2008 |

Professional Experience

- | | | |
|------------------------|--|--------------|
| Assistant Professor | <i>University of Colorado Boulder</i> | 2017–Present |
| Miller Research Fellow | <i>University of California Berkeley</i> | 2014–2017 |

Awards and Honors

- | | | |
|---|--|-------------|
| Miller Research Fellowship | <i>Miller Institute, UC Berkeley</i> | 2014–2017 |
| Springer ISMSC2015 Poster Prize | <i>International Symposium on Macrocyclic & Supramolecular Chemistry</i> | 2015 |
| NSF East Asia and Pacific Summer Institutes
JSPS Summer Program Fellow | <i>University of Tokyo</i> | Summer 2013 |
| NSF Graduate Research Fellowship | <i>National Science Foundation</i> | 2010–2013 |
| World Class University Project Visiting Student | <i>Korea Advanced Institute of Science and Technology (KAIST)</i> | Fall 2011 |
| Global Center of Excellence Visiting Student | <i>University of Tokyo</i> | Spring 2010 |
| Springer ISMSC2010 Poster Prize | <i>International Symposium on Macrocyclic & Supramolecular Chemistry</i> | 2010 |
| Graduate Assistance in Areas of National Need | <i>U.S. Department of Education</i> | 2008–2009 |
| John G. and Mildred Breiland Fellowship | <i>Luther College Chemistry Dept.</i> | 2007–2008 |
| NSF Research Experience for Undergraduates | <i>Chulabhorn Research Institute</i> | Summer 2007 |
| NSF Research Experience for Undergraduates | <i>Coe College</i> | Summer 2006 |
| Regents Scholarship | <i>Luther College</i> | 2004–2008 |

Books

CJ Bruns, JF Stoddart, *The Nature of the Mechanical Bond: From Molecules to Machines*. Hoboken: John Wiley & Sons, 2016. 761 pp. ISBN: 9781119044000

Publications (2450 Citations, *h*-index 22, *i*10 index 30) * denotes equal contribution

- CJ Bruns**. Exploring and Exploiting the Symmetry-Breaking Effect of Cyclodextrins in Mechanomolecules. *Symmetry* **2019**, *11*, 1249–1271
- CJ Bruns**. The Rise of Smart Tattoos. *TEDxMileHigh*, **2019**. <https://www.tedxmilehigh.com/rise-smart-tattoos/>
- D Sluysmans, F Devaux, **CJ Bruns**, JF Stoddart, A-S Duwez. Dynamic Force Spectroscopy of Synthetic Oligorotaxane Foldamers. *Proc. Natl. Acad. Sci. U.S.A.* **2018**, *115*, 9362–9366
- D Sluysmans, S Hubert, **CJ Bruns**, Z Zhu, JF Stoddart, A-S Duwez. Synthetic Oligorotaxanes Exert High Forces When Folding Under Mechanical Load. *Nature Nanotech.* **2018**, *13*, 209–213
- S Loser, SJ Lou, BM Savoie, **CJ Bruns**, A Timalisina, MJ Leonardi, T Harschneck, R Turrisi, N Zhou, CL Stern, AA Sarjeant, A Facchetti, RPH Chang, SI Stupp, MA Ratner, LX Chen, TJ Marks. Systematic Evaluation of Structure-Property Relationships in Heteroacene-Diketopyrrolopyrrole Molecular Donors for Organic Solar Cells. *J. Mater. Chem. A* **2017**, *5*, 9217–9232
- CC Slack, JA Finbloom, K Jeong, **CJ Bruns**, DE Wemmer, A Pines, MB Francis. Rotaxane Probes for Protease Detection by ¹²⁹Xe HyperCEST NMR. *Chem. Commun.* **2017**, *53*, 1076–1079
- CJ Bruns**, H Liu, MB Francis. Near-Quantitative Aqueous Synthesis of Rotaxanes via Bioconjugation to Oligopeptides and Proteins. *J. Am. Chem. Soc.* **2016**, *138*, 15307–15310

26. JA Finbloom, CC Slack, **CJ Bruns**, K Jeong, DE Wemmer, A Pines, MB Francis. Rotaxane-Mediated Suppression and Activation of Cucurbit[6]uril for Molecular Detection by ^{129}Xe HyperCEST NMR. *Chem. Commun.* **2016**, 52, 3119–3122
25. T Aytun, PJ Santos, **CJ Bruns**, D Huang, AR Koltonow, M Olvera de la Cruz, SI Stupp. Self-Assembling Tripodal Small-Molecule Donors for Bulk Heterojunction Solar Cells. *J. Phys. Chem. C* **2016**, 120, 3602–3611
24. X Hou,* C Ke,* **CJ Bruns**, PR McGonigal, RB Pettman, JF Stoddart. Tunable Solid-State Fluorescent Materials for Supramolecular Encryption. *Nature Commun.* **2015**, 6, 6884
23. **CJ Bruns**,* D Fujita,* M Hoshino, S Sato, JF Stoddart, M Fujita. Emergent Ion-Gated Binding of Cationic Host-Guest Complexes Within Cationic $\text{M}_{12}\text{L}_{24}$ Molecular Flasks. *J. Am. Chem. Soc.* **2014**, 136, 12027–12034
22. **CJ Bruns**, JF Stoddart. Rotaxane-Based Molecular Muscles. *Acc. Chem. Res.* **2014**, 47, 2186–2199
21. **CJ Bruns**, M Frasconi, J Iehl, KJ Hartlieb, ST Schneebeli, C Cheng, SI Stupp, JF Stoddart. Redox Switchable Daisy Chains Driven by Radical-Radical Interactions. *J. Am. Chem. Soc.* **2014**, 136, 4714–4723 **Featured in JACS Spotlights**
20. **CJ Bruns**, J Li, M Frasconi, ST Schneebeli, J Iehl, H-P Jacquot de Rouville, SI Stupp, GA Voth, JF Stoddart. An Electrochemically and Thermally Switchable Donor-Acceptor [c2]Daisy Chain Rotaxane. *Angew. Chem., Int. Ed.* **2014**, 53, 1953–1958
19. **CJ Bruns**, JF Stoddart. Mechanically Interlaced and Interlocked Donor-Acceptor Foldamers. *Adv. Polym. Sci.* **2013**, 261, 271–294
18. AC Fahrenbach, **CJ Bruns**, H Li, A Trabolsi, A Coskun, JF Stoddart. Ground-State Kinetics of Bistable Redox-Active Donor-Acceptor Mechanically Interlocked Molecules. *Acc. Chem. Res.* **2014**, 47, 482–493
17. **CJ Bruns**,* DJ Herman,* JB Minuzzo, JA Lehrman, SI Stupp. Rationalizing Molecular Design in Electrodeposition of Anisotropic Lamellar Nanostructures. *Chem. Mater.* **2013**, 25, 4330–4339
16. A Ruiz-Carretero, T Aytun, **CJ Bruns**, CJ Newcomb, W-W Tsai, SI Stupp. Stepwise Self-Assembly to Improve Solar Cell Morphology. *J. Mat. Chem. A* **2013**, 1, 11674–11681
15. A Guerrero, SC Loser, G Garcia-Belmonte, **CJ Bruns**, J Smith, H Miyauchi, SI Stupp, TJ Marks, J Bisquert. Solution-Processed Small Molecule: Fullerene Bulk-Heterojunction Solar Cells: Impedance Spectroscopy Deduced Bulk and Interfacial Limits to Fill-Factor. *Phys. Chem. Chem. Phys.* **2013**, 15, 16456–16462
14. M Juriček,* JC Barnes,* EJ Dale, W-G Liu, NL Strutt, **CJ Bruns**, NA Vermeulen, K Ghooray, AA Sarjeant, CL Stern, YY Botros, WA Goddard III, JF Stoddart. Ex^2Box : Interdependent Modes of Binding in a Two-Nanometer-Long Synthetic Receptor. *J. Am. Chem. Soc.* **2013**, 135, 12736–12746
13. **CJ Bruns**, JF Stoddart. Molecular Machines Muscle Up. *Nature Nanotech.* **2013**, 8, 9–10
12. Z Zhu, **CJ Bruns**, H Li, J Lei, C Ke, Z Liu, S Shafaie, HM Colquhoun, JF Stoddart. Synthesis and Solution-State Dynamics of Donor-Acceptor Oligorotaxane Foldamers. *Chem. Sci.* **2013**, 4, 1470–1483
11. JC Barnes,* M Juriček,* NL Strutt, M Frasconi, S Sampath, MA Giesener, PL McGrier, **CJ Bruns**, CL Stern, AA Sarjeant, JF Stoddart. ExBox : A Polycyclic Aromatic Hydrocarbon Scavenger. *J. Am. Chem. Soc.* **2013**, 135, 183–192
10. **CJ Bruns**, JF Stoddart. The Mechanical Bond: A Work of Art. *Top. Curr. Chem.* **2012**, 323, 19–72
9. CM Gothard,* **CJ Bruns**,* NA Gothard, BA Grzybowski, JF Stoddart. Modular Synthesis of Bipyridinium Oligomers and Corresponding Donor-Acceptor Oligorotaxanes with Crown Ethers. *Org. Lett.* **2012**, 14, 5066–5069
8. H-P Jacquot de Rouville, J Iehl, **CJ Bruns**, PL McGrier, M Frasconi, AA Sarjeant, JF Stoddart. A Neutral Naphthalene Diimide [2]Rotaxane. *Org. Lett.* **2012**, 14, 5188–5191
7. AN Basuray, H-P Jacquot de Rouville, KJ Hartlieb, T Kikuchi, NL Strutt, **CJ Bruns**, MW Ambrogio, A-J Avestro, ST Schneebeli, AC Fahrenbach, JF Stoddart. The Chameleonic Nature of Diazopyrenium Recognition Processes. *Angew. Chem., Int. Ed.* **2012**, 51, 11872–11879
6. AC Fahrenbach, KJ Hartlieb, C-H Sue, **CJ Bruns**, G Barin, S Basu, MA Olson, YY Botros, A Bagabas, N Khadry, JF Stoddart. Rapid Thermally Assisted Donor-Acceptor Catenation. *Chem. Commun.* **2012**, 48, 9141–9143

5. AC Fahrenbach, **CJ Bruns**, D Cao, JF Stoddart. Ground-State Thermodynamics of Redox-Active Donor-Acceptor Mechanically Interlocked Molecules. *Acc. Chem. Res.* **2012**, *45*, 1581–1592
4. S Loser, **CJ Bruns**, H Miyauchi, R Ponce Ortiz, A Facchetti, SI Stupp, TJ Marks. A Naphthodithiophene-Diketopyrrolopyrrole Donor Molecule for Efficient Solution-Processed Solar Cells. *J. Am. Chem. Soc.* **2011**, *133*, 8142–8145.
3. **CJ Bruns**, S Basu, JF Stoddart. Improved Synthesis of 1,5-Dinaphtho[38]Crown-10. *Tetrahedron Lett.* **2010**, *51*, 983–986
2. RS Forgan, DC Friedman, CL Stern, **CJ Bruns**, JF Stoddart. Directed Self-Assembly of a Ring-in-Ring Complex. *Chem. Commun.* **2010**, 5861–5863 **Front Cover**
1. S Boonya-Udtayan, N Yotapan, C Woo, **CJ Bruns**, S Ruchirawat, N Thasana Synthesis and Biological Activities of Azalamellarins. *Chem. Asian J.* **2010**, *5*, 2113–2123

Funding	Amount	Role	Award Date
American Chemical Society Petroleum Research Fund Doctoral New Investigator (ACS PRF DNI)	\$110,000	PI	Summer 2018
CU Boulder Interdisciplinary Research Themes (IRT) Seed Grant – Multifunctional Materials	\$15,000	Co-PI	Spring 2018
CU Boulder Interdisciplinary Research Themes (IRT) Seed Grant – Autonomous Systems	\$15,000	Co-PI	Spring 2018

Students Mentored	Dates	Current Position
Emily Powis, <i>CU Boulder</i>	Summer 2019	Undergraduate Student, USC
Ian Stokes, <i>CU Boulder</i>	Summer 2019	Undergraduate Student, Northwestern
Sean Keyser, <i>CU Boulder</i>	May–December 2019	Masters Student Assistant, CU
Kiley Hartigan, <i>CU Boulder</i>	April 2019–present	Research Assistant, CU
Nicole Leon-Molina, <i>CU Boulder</i>	Spring 2019	Undergraduate Student, CU
Aya Ishikawa, <i>CU Boulder</i>	March 2019–present	Undergraduate Student, CU
Sarah Sadeq, <i>CU Boulder</i>	September–December 2018	Undergraduate Student, CU
Purnendu, <i>CU Boulder</i>	September 2018–present	Graduate Student, CU
Hyejin Kwon, <i>CU Boulder</i>	June 2018–present	Postdoctoral Associate, CU
Kailey Shara, <i>CU Boulder</i>	June 2018–present	Graduate Student, CU
Karan Dikshit, <i>CU Boulder</i>	January 2018–present	Graduate Student, CU
Phillip Vo, <i>CU Boulder</i>	January–December 2018	Undergraduate Student, CU
Jesse Butterfield, <i>CU Boulder</i>	September 2017–present	Graduate Student, CU
Hanwei Liu, <i>UC Berkeley</i>	March 2015–June 2016	Graduate Student, Caltech
Peter J. Santos, <i>Northwestern</i>	December 2012–May 2014	Graduate Student, MIT
Brett Anderson, <i>Northwestern</i>	September 2011–May 2012	Radiology Specialist, US Army

Courses Developed	Course Number	Enrollment	Semester
Color	ATLS-4519/5519	11	Fall 2017

Courses Taught	Course Number	Enrollment	Semester
Color	ATLS-4519/5519	10	Fall 2019
Chemistry for Materials and Energy Science	MCEN-1024-110	54	Fall 2019
Chemistry for Materials and Energy Science	MCEN-1024-120	66	Fall 2019
Color	ATLS-4519/5519	22	Fall 2018
Chemistry for Materials and Energy Science	MCEN-1020	43	Spring 2018
Color	ATLS-4519/5519	11	Fall 2017

Oral Presentations

16. Tattoos for Health: The Future of Smart Tattoos
Vesterheim Museum Fall Lecture Series, Luther College, Decorah, IA 24 November 2019
15. Biomedical Tattoos for Human Health
CU Anschutz School of Pharmacy Graduate Seminar 17 October 2019

14. The Future of Tattoos 28 September 2019
Colorado Tattoo Convention & Expo, Denver, CO
13. Cultivating Creativity 27 September 2019
ACTIVE Faculty Development and Leadership Program, CU Boulder
12. Chameleon Tattoos 25 September 2019
Teen Science Café, Belmar Library, Lakewood, CO
11. Creativity in Biomedical Research 15 September 2019
Boettcher Biomedical Summit, Denver, CO
10. Beyond Wellness Wearables: Get Ready for Smart Tattoos 12 September 2019
me Convention by SXSW / Mercedes-Benz, Frankfurt, Germany
9. Can a Tattoo Help You Stay Healthy? go.ted.com/carsonbruns 1 December 2018
TEDxMileHigh, Denver, Colorado **>500,00 Online Views**
8. Passionate Optimization (co-presented with Ben Shapiro) 1 November 2018
ACTIVE Faculty Development and Leadership Program, CU Boulder
7. Tech Tattoos: Tissue Engineering with Dermally Implanted Nanomaterials. 10 October 2018
International Symposium on Advanced Molecular Sciences
East China University of Science and Technology, Shanghai, China
6. Leveraging Artificial Molecular Machines in Active Soft Matter Systems 10 August 2018
CU Boulder Active Matter Workshop, Boulder, Colorado
5. Biochemical Applications of Rotaxanes 21 July 2016
Molecular Rotors, Motors, and Switches Conference. Telluride Science
Research Center, Telluride, Colorado
4. Host-Guest Chemistry Inside of Large, Self-Assembled Molecular Flasks 7 November 2014
5th Interdisciplinary Science Forum of the JSPS-US-AA
The University of Florida, Gainesville
3. Emergent Ion-Gated Binding of Host-Guest Complexes Within M₁₂L₂₄ Molecular Flasks 13 August 2014
248th ACS National Meeting and Exposition, San Francisco
2. The Art and Science of (re)Presentation and the Mechanical Bond 1 July 2014
Molecular Rotors, Motors, and Switches Workshop. Telluride Science
Research Center, Telluride, Colorado, United States
1. Self-Assembly of Organic-Inorganic Hybrids 1 March 2011
Northwestern University Department of Chemistry Organic Seminar

Poster Presentations

9. **Bruns, C. J.**; Liu, H.; Finbloom, J. A.; Slack, C. C.; Jeong, K.; Wemmer, D. E.; Pines, A.; Francis, M. B. Utilizing the Mechanical Bonds of Rotaxanes in Bioconjugation and Controlled-Release Applications 10–14 July 2016
11th International Symposium on Macrocyclic & Supramolecular Chemistry (ISMSC), Seoul, South Korea
8. **Bruns, C. J.**; Liu, H.; Francis, M. B. Protein Mounted Rotaxanes. 28 June–2 July 2015
10th International Symposium on Macrocyclic & Supramolecular Chemistry (ISMSC), Strasbourg, France
Selected as a winner of the Springer ISMSC2015 Poster Prize
7. **Bruns, C. J.**; Frasconi, M.; Zhu, Z.; Sluysmans, D.; Stupp, S.; Duwez, A.-S.; Stoddart, J. F. Rotaxane-Based Molecular Muscles 7–12 June 2015
Gordon Research Conference on Artificial Molecular Switches and Motors, Easton, Massachusetts, USA
6. **Bruns, C. J.**; Frasconi, M.; Zhu, Z.; Sluysmans, D.; Stupp, S.; Duwez, A.-S.; Stoddart, J. F. Rotaxane-Based Molecular Muscles

2015 MRS Spring Meeting, San Francisco, USA

6–10 April 2015

5. **Bruns, C. J.**; Stoddart, J. F. Molecular Switches and Machines with Mechanical Bonds
Molecular Rotors, Switches, and Machines Workshop, Telluride Science Research Center, Telluride, Colorado, USA 30 June–4 July 2014
4. **Bruns, C. J.**; Frasconi, M.; Li, J.; Schneebeli, S. T.; Iehl, J.; Jacquot de Rouville, H.-P.; Hartlieb, K. J.; Cheng, C.; Stupp, S. I.; Voth, G. A.; Stoddart, J. F. Donor-Acceptor Daisy Chain Rotaxanes: Thermally and Electrochemically Switchable Molecular Muscles
RSC Macrocyclic and Supramolecular Chemistry Meeting. University of Glasgow, Scotland 16–17 December 2013
3. **Bruns, C. J.**; Tayi, A. S.; Stupp, S. I.; Stoddart, J. F.
From Switchable Mechanical Molecules to Artificial Muscles
DOE Energy Frontiers Research Centers Review: Non-Equilibrium Energy Research Center. Baltimore, Maryland, USA 5 April 2012
2. **Bruns, C. J.**; Fahrenbach, A. C.; Fujita, D.; Basu, S.; Fujita, M.; Stoddart, J. F.
Pseudorotaxanation Within an Electrostatically-Gated $M_{12}L_{24}$ Coordination Sphere.
5th International Symposium on Macrocyclic & Supramolecular Chemistry (ISMSC), Nara, Japan 6–10 June 2010
Selected as a winner of the Springer ISMSC2010 Poster Prize
1. **Bruns, C. J.**; Thasana, N. Cu^I-Mediated Microwave-Assisted Synthesis of Azalamellarins
235th National ACS Meeting. New Orleans, Louisiana, USA 6–10 April 2008

Professional Memberships

Phi Beta Kappa Honors Society	Inducted 2008
Phi Lambda Upsilon Honorary Chemical Society <i>Alpha Gamma Chapter, Northwestern University</i>	Inducted 2010
JSPS-US Fellows Alumni Association	Inducted 2013
American Chemical Society	2011–Present
Materials Research Society	2015–Present
American Institute of Chemical Engineers	2015–Present
The Society of Rheology	2019–Present

Service

Editorial Board, <i>Symmetry</i> Journal	2019–present
ATLAS Executive Committee	2018–2020
Chair, Graduate Engineering Annual Research & Recruitment (GEARRS)	AY 2019–2020
Vice Chair, Graduate Engineering Annual Research & Recruitment (GEARRS)	AY 2018–2019
CU Boulder Department of Mechanical Engineering Graduate Committee	2018–2020
CU Boulder CEAS Soft Materials Faculty Search Committee	AY 2017–2018
ATLAS Institute ARPAC Self-Study Committee	AY 2017–2018
Northwestern Gelowitz Award Selection Committee	May 2013
Miller Institute Multidisciplinary Symposium Planning Committee	AY 2015–2016
Referee for <i>JACS</i> , <i>Nature Chemistry</i> , <i>Nature Communications</i> , <i>Advanced Materials</i> , <i>PNAS</i> , <i>Journal of Chemical Physics</i> , <i>Symmetry</i>	

Responsible Conduct of Research Training

August 2011/January 2014
www.citiprogram.org

Boulder, Colorado

December 2019