

Robert R. Knowles, Ph.D.

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EMPLOYMENT

Professor of Chemistry, <i>Princeton University</i>	Mar. 2017 – present
Assistant Professor of Chemistry, <i>Princeton University</i>	July 2011 – Mar. 2017
NIH NRSA Postdoctoral Fellow, <i>Harvard University</i> Advisor: Eric Jacobsen	Dec. 2008 – June 2011

EDUCATION

Doctor of Philosophy, <i>California Institute of Technology</i> Advisor: David MacMillan	July 2003 – Oct. 2008
Bachelor of Science in Chemistry, <i>College of William and Mary</i> Advisors: Robert Hinkle and David Kranbuehl	Sep. 1999 – May 2003

AWARDS & HONORS

• Arthur C. Cope Scholar Award (<i>American Chemical Society</i>)	2018
• Mitsui Catalysis Science Award of Encouragement	2018
• E. Bright Wilson Prize (<i>Harvard University, Dept. of Chemistry and Chemical Biology</i>)	2018
• Novartis Early Career Award in Organic Chemistry	2017
• Camille Dreyfus Teacher-Scholar Award	2017
• Grammaticakis-Neumann Prize (<i>Swiss Chemical Society</i>)	2017
• Amgen Young Investigator Award	2016
• Eli Lilly Grantee Award	2016
• Bristol Myers Squibb Innovation Grant	2015
• Alfred P. Sloan Foundation Research Fellow	2014
• Thieme Chemistry Journal Award	2013
• ACS PRF Doctoral New Investigator	2012
• NIH NRSA Postdoctoral Fellow, <i>Harvard University</i>	2008 – 2010
• Eli Lilly Graduate Fellowship in Organic Chemistry, <i>California Institute of Technology</i>	2004 – 2005
• Institute Graduate Fellowship, <i>California Institute of Technology</i>	2003 – 2004
• James Monroe Scholar, <i>College of William and Mary</i>	1999 – 2003

PUBLICATIONS

38. Enantioselective Hydroamination of Alkenes with Sulfonamides Enabled by Proton-Coupled Electron Transfer. Roos, C. B.; Demaerel, J.; Graff, D.E.; Knowles, R. R. *J. Am. Chem. Soc.* **2020**, *142*, just accepted.
37. Light-driven Depolymerization of Native Lignin Enabled by Proton-Coupled Electron Transfer. Nguyen, S. T.; Murray, P. R. M.; Knowles, R. R. *ACS Catalysis*, **2020**, *10*, 800–805.
36. Light-driven Deracemization Enabled by Excited-State Electron Transfer. Shin, N. Y.; Ryss, J. M.; Zhang, X.; Miller, S. J.; Knowles, R. R. *Science*, **2019**, *366*, 364–369.
35. Anti-Markovnikov Hydroamination of Unactivated Alkenes with Primary Alkyl Amines. Miller, D. C.; Ganley, J. M.; Musacchio, A. J.; Sherwood, T. C.; Ewing, W. R.; Knowles, R. R. *J. Am. Chem. Soc.* **2019**, *141*, 16590–16594.
34. Understanding Chemoselectivity in Proton-Coupled Electron Transfer: A Kinetic Study of Amide and Thiol Activation. Qui, G.; R.; Knowles, R. R. *J. Am. Chem. Soc.* **2019**, *141*, 16574–16578.
33. C-H Alkylation via Multisite Proton-Coupled Electron Transfer of an Aliphatic C-H Bond. Morton, C. M.; Zhu, Q.; Ripberger, H.; Troian-Gauthier, L.; Toa, Z. S. D.; Knowles, R. R.; Alexanian, E. J. *J. Am. Chem. Soc.* **2019**, *141*, 13253–13260.
32. Catalytic Ring Expansions of Cyclic Alcohols Enabled by Proton-Coupled Electron Transfer. Zhao, K.; Yamashita, K.; Carpenter, J.; Sherwood, T. C.; Ewing, W. R.; Cheng, P. T. W.; Knowles, R. R. *J. Am. Chem. Soc.* **2019**, *141*, 8752–8757.
31. PCET-Enabled Olefin Hydroamidation Reactions with *N*-Alkyl Amides. Nguyen, S. T.; Zhu, Q.; Knowles, R. R. *ACS Catalysis* **2019**, *9*, 4502–4507.
30. Evaluation of Excited State Bond Weakening for Ammonia Synthesis from a Manganese Nitride: Stepwise Proton-Coupled Electron Transfer is Preferred Over Hydrogen Atom Transfer. Loose, F.; Wang, D.; Tian, L.; Scholes, G. D.; Knowles, R. R.; Chirik, P. J. *Chem. Comm.* **2019**, *55*, 5595–5598.
29. Decarboxylative Intramolecular Arene Alkylation Using *N*-(Acyloxy)phthalimides, as Organic Photocatalyst, and Visible Light. Sherwood, T. C.; Xiao, H.-Y.; Bhaskar, R. G.; Simmons, E. M.; Zaretsky, S.; Rauch, M. P.; Knowles, R. R. and Dhar, T. G. M. *J. Org. Chem.* **2019**, *84*, 8360–8379.
28. N–H Bond Formation in a Manganese(V) Nitride Yields Ammonia by Light-Driven Proton-Coupled Electron Transfer. Wang, D.; Loose, F.; Chirik, P. J.; Knowles, R. R. *J. Am. Chem. Soc.* **2019**, *141*, 4795–4799.
27. Rate-Driving Force Relationships in the Multisite PCET Activation of Ketones. Qui, G.; R.; Knowles, R. R. *J. Am. Chem. Soc.* **2019**, *141*, 2721–2730.
26. A Redox Strategy for Light-Driven, Out-of-Equilibrium Isomerizations and Application to Catalytic C–C Bond Cleavage Reactions. Ota, E.; Wang, H.; Frye, N. L.; R.; Knowles, R. R. *J. Am. Chem. Soc.* **2019**, *141*, 1457–1462.
25. Applications of and Prospects for Triplet-Triplet Annihilation Photon Upconversion. Rauch, M. P.; R.; Knowles, R. R. *CHIMIA*. **2018**, *72*, 501–507. (*Laureate Article for Grammaticakis-Neumann Prize*)

Robert R. Knowles, Ph.D.

24. Enantioselective Synthesis of Pyrroloindolines via Non-Covalent Stabilization of Indole Radical Cations and Applications to the Synthesis of Alkaloid Natural Products. Gentry, E. C.; Rono, L. J.; Hale, M. E.; Matsuura, R.; Knowles, R. R. *J. Am. Chem. Soc.* **2018**, *140*, 3394–3402.
23. Intermolecular Anti-Markovnikov Hydroamination of Unactivated Alkenes with Sulfonamides Enabled by Proton-Coupled Electron Transfer. Zhu, Q.; Graf, D. E.; Knowles, R. R. *J. Am. Chem. Soc.* **2018**, *140*, 741–747.
22. Catalytic Intermolecular Hydroaminations of Unactivated Olefins with Secondary Alkyl Amines. Musacchio, A. J.; Lainhart, B. C.; Zhang, X.; Naguib, S. G.; Sherwood, T. C.; Knowles, R. R. *Science*, **2017**, *355*, 727–730.
21. Catalytic Alkylation of Remote C-H Bonds Enabled by Proton-Coupled Electron Transfer. Choi, G. C.; Zhu, Q.; Miller, D. C.; Gu, C. J.; Knowles, R. R. *Nature*, **2016**, *539*, 268–271.
20. Catalytic Ring-Opening of Cyclic Alcohols Enabled by PCET Activation of Strong O-H Bonds. Yayla, H. G.; Wang, H.; Tarantino, K. T.; Orbe, H. S.; Knowles, R. R. *J. Am. Chem. Soc.* **2016**, *138*, 10794–10797.
19. Synthetic Applications of Proton-Coupled Electron Transfer. Gentry, E. C.; Knowles, R. R. *Acc. Chem. Res.* **2016**, *49*, 1546–1556.
18. Catalytic Carbocation Generation Enabled by the Mesolytic Cleavage of Alkoxyamine Radical Cations. Zhu, Q.; Gentry, E. C.; Knowles, R. R. *Angew. Chem. Int. Ed.* **2016**, *55*, 9969–9973.
17. Proton-Coupled Electron Transfer in Organic Synthesis: Fundamentals, Applications and Opportunities. Miller, D. C.; Tarantino, K. T.; Knowles, R. R. *Topics in Current Chemistry* **2016**, *374* (30), 145–203. DOI:10.1007/s41061-016-0030-6.
16. Catalytic C-N Bond Forming Reactions Enabled by Proton-Coupled Electron Transfer Activation of Amide N-H Bonds. Nguyen, L. Q.; Knowles, R. R. *ACS Catalysis* **2016**, *6*, 2894–2903.
15. Discovery and Mechanistic Study of a Photocatalytic Indoline Dehydrogenation for the Synthesis of Elbasvir. Yayla, H. G.; Peng, F.; Mangion, I. K.; McLaughlin, M.; Campeau, L.-C.; Davies, I. W.; DiRocco, D. A.; Knowles, R. R. *Chem. Sci.* **2016**, *7*, 2066–2073.
14. Catalytic Olefin Hydroamidation Enabled by Proton-Coupled Electron Transfer. Miller, D. C.; Choi, G. C.; Orbe, H. S.; Knowles, R. R. *J. Am. Chem. Soc.* **2015**, *137*, 13492–13495.
13. Reaching Your Full (Over)potential: A Novel Approach to Electrocatalytic Oxygen Reduction. Knowles, R. R. *ACS Central Science* **2015**, *1*, 224–225.
12. Catalytic Alkene Carboamination Enabled by Oxidative Proton-Coupled Electron Transfer. Choi, G. C.; Knowles, R. R. *J. Am. Chem. Soc.* **2015**, *137*, 9226–9229.
11. Bond Weakening Catalysis: Conjugate Aminations Enabled by the Soft Homolysis of Strong N-H Bonds. Tarantino, K. T.; Miller, D. C.; Callon, T. A.; Knowles, R. R. *J. Am. Chem. Soc.* **2015**, *137*, 6440–6443.

Robert R. Knowles, Ph.D.

10. Proton-Coupled Electron Transfer in Organic Synthesis: Novel Homolytic Bond Activations and Catalytic Asymmetric Reactions with Free Radicals. Yayla, H. G.; Knowles, R. R. *Synlett* **2014**, *25*, 2819–2826 (*Synfacts* article).
9. Catalytic Olefin Hydroamination with Aminium Radical Cations: A Photoredox Method for Direct C-N Bond Formation. Musacchio, A. J.; Nguyen, L. Q.; Beard, G. H.; Knowles, R. R. *J. Am. Chem. Soc.* **2014**, *136*, 12217–12220.
8. Enantioselective Photoredox Catalysis Enabled by Proton-Coupled Electron Transfer. Development of an Asymmetric Aza-Pinacol Cyclization Rono, L. J.; Yayla, H. G.; Wang, D. Y.; Armstrong, M. F.; Knowles, R. R. *J. Am. Chem. Soc.* **2013**, *135*, 17735–17738.
7. Catalytic Ketyl Olefin Cyclizations Enabled by Proton-Coupled Electron Transfer. Tarantino, K. T.; Liu, P.; Knowles, R. R. *J. Am. Chem. Soc.* **2013**, *135*, 10022–10015.

PUBLICATIONS FROM POSTDOCTORAL, GRADUATE & UNDERGRADUATE WORK

6. Total Synthesis of Diazonamide A. Knowles, R. R.; Carpenter, J. E.; Blakey, S. B.; Kayano, A.; Mangion, I. K.; MacMillan D. W. C. *Chemical Science* **2011**, *2*, 308–311.
5. Attractive Non-Covalent Interactions in Asymmetric Catalysis: Links Between Enzymes and Small-Molecule Catalysts. Knowles, R. R.; Jacobsen, E. N. *Proc. Nat. Acad. Sci. USA* **2010**, *107*, 20678–20685.
4. Concerning the Mechanism of the FeCl₃-Catalyzed α -Oxyamination of Aldehydes. Evidence for a Non-SOMO Activation Pathway. Van Humbeck, J. F.; Simonovich, S. P.; Knowles, R. R.; MacMillan D. W. C. *J. Am. Chem. Soc.* **2010**, *132*, 10012–10014.
3. Enantioselective Thiourea-Catalyzed Cationic Polycyclizations. Knowles, R. R.; Lin, S.; Jacobsen, E. N. *J. Am. Chem. Soc.* **2010**, *132*, 5030–5032.
2. Modelling the Effects of Confinement on the Glass Transition Temperatures and Segmental Mobility. Kranbuehl, D. E.; Knowles, R. R.; Hossain, A.; Hurt, M. *Journal of Physics: Condensed Matter* **2003**, *15*, S1019–S1029.
1. Monte Carlo Simulations of the Effect of Confinement Geometry on the Lowering of the Glass Transition Temperature. Kranbuehl, D. E.; Knowles, R. R.; Hossain, A.; Gilchrist, A. *Journal of Non-Crystalline Solids* **2002**, *307*, 495–502.

INVITED LECTURES

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|---|-----------|
| 1. Merck – Rahway, NJ | Jan. 2014 |
| 2. SUNY – Binghamton | Mar. 2014 |
| 3. 2 nd International Conference on Proton-Coupled Electron Transfer – Uppsala, Sweden | July 2014 |

Robert R. Knowles, Ph.D.

4.	SUNY – Albany	Sep. 2014
5.	Brooklyn College – City University of New York	Oct. 2014
6.	Johns Hopkins University	Oct. 2014
7.	North Jersey ACS Symposium (<i>Award symposium in honor of Dave MacMillan</i>) – Piscataway, NJ	Dec. 2014
8.	Bristol Myers Squibb – Wallingford, CT	Jan. 2015
9.	Bristol Myers Squibb – Hopewell, NJ	Feb. 2015
10.	Inorganic Reaction Mechanisms Gordon Conference – Galveston, TX	Mar. 2015
11.	249 th ACS National Meeting (<i>Fresenius Symposium in honor of Abby Doyle</i>) – Denver, CO	Mar. 2015
12.	Bristol Myers Squibb – New Brunswick, NJ	May 2015
13.	Gilead Biosciences – San Francisco, CA	May 2015
14.	Heterocycles Gordon Conference – Newport, RI	June 2015
15.	Eli Lilly – Indianapolis, IN	June 2015
16.	Nanyang Technological University – Singapore	July 2015
17.	7 th Pacific Symposium on Radical Chemistry – Singapore	July 2015
18.	Natural Products Gordon Conference – Andover, NH	July 2015
19.	250 th ACS National Meeting (<i>SABIC Symposium in honor of Melanie Sanford</i>) – Boston, MA	Aug. 2015
20.	Amgen – Cambridge, MA	Aug. 2015
21.	Lehigh University	Sep. 2015
22.	ICIQ Symposium on Photocatalysis – Tarragona, Spain	Oct. 2015
23.	Rutgers University	Oct. 2015
24.	University of Ottawa (<i>Student-Invited Speaker</i>)	Oct. 2015
25.	Hunter College	Nov. 2015
26.	Emory University	Nov. 2015
27.	Georgia State University	Nov. 2015
28.	Boston University	Nov. 2015
29.	University of California – Berkeley (<i>Amgen Lecturer</i>)	Dec. 2015
30.	New Jersey Biotechnology Chemistry Consortium	Dec. 2015
31.	PacifiChem – Honolulu, HI	Dec. 2015
32.	University of Washington	Jan. 2016
33.	Purdue University	Jan. 2016
34.	University of Michigan – Ann Arbor	Jan. 2016
35.	Wesleyan University	Jan. 2016
36.	University of Illinois – Urbana-Champaign	Feb. 2016
37.	Colorado State University (<i>Aldrich Lecturer</i>)	Feb. 2016
38.	University of Wisconsin – Madison	Mar. 2016
39.	Nagoya University – Nagoya, Japan	Mar. 2016
40.	Kyoto University – Kyoto, Japan	Mar. 2016
41.	RIKEN – Tokyo, Japan	Mar. 2016
42.	University of Tokyo – Tokyo, Japan	Mar. 2016
43.	North Carolina State University	Apr. 2016
44.	MIT (<i>Student-Invited Speaker</i>)	May 2016
45.	AbbVie Pharmaceuticals – Worcester, MA	May 2016
46.	Janssen Pharmaceuticals – San Diego, CA	June 2016
47.	Organic Reactions and Processes Gordon Conference – Easton, MA	July 2016
48.	Stereochemistry Gordon Conference – Newport, RI	July 2016

Robert R. Knowles, Ph.D.

49.	Texas A&M University	Sept. 2016
50.	Green Chemistry Institute Pharmaceutical Roundtable Symposium – Novartis, Cambridge, MA	Oct. 2016
51.	Amgen – Cambridge, MA (<i>Young Investigator Award Symposium</i>)	Oct. 2016
52.	Cornell University	Nov. 2016
53.	Stanford University	Nov. 2016
54.	Caltech	Nov. 2016
55.	Columbia University (<i>Padwa Lecturer</i>)	Dec. 2016
56.	University of Manchester – Manchester, UK	Jan. 2017
57.	University of Cambridge – Cambridge, UK	Jan. 2017
58.	Imperial College London – London, UK	Jan. 2017
59.	University of Oxford – Oxford, UK	Jan. 2017
60.	University of Bristol – Bristol, UK	Jan. 2017
61.	University of North Carolina – Chapel Hill	Feb. 2017
62.	University of Utah	Mar. 2017
63.	Brigham Young University	Mar. 2017
64.	University of Texas, Southwestern Medical Center (<i>Excellence in Chemistry Symposium</i>)	Mar. 2017
65.	Indiana University	Apr. 2017
66.	Yale University (<i>Bristol-Myers Squibb Lecturer</i>)	Apr. 2017
67.	GlaxoSmithKline – Upper Merion, PA	Apr. 2017
68.	Boehringer-Ingelheim – Ridgefield, CT	Apr. 2017
69.	Genentech – (<i>Keynote speaker, Graduate Research Symposium</i>) – South San Francisco, CA	May 2017
70.	Bristol Myers Squibb – Discovery Chemistry Retreat - Hopewell, NJ	May 2017
71.	Canadian Society for Chemistry Meeting (<i>Advances in Radicals Symposium</i>) – Toronto, Canada	May 2017
72.	University of Muenster – Muenster, Germany	June 2017
73.	Max Planck Institute für Kohlenforschung – Mülheim, Germany	June 2017
74.	International Conference on Hydrogen Atom Transfer – Rome, Italy	July 2017
75.	Pfizer – Groton, CT	July 2017
76.	Swiss Chemical Society Meeting (<i>Grammaticakis-Neumann Award Lecture</i>) – Bern, Switzerland	Aug. 2017
77.	City College of New York	Sep. 2017
78.	AbbVie Process Chemistry – Chicago, IL	Oct. 2017
79.	Northwestern University – Evanston, IL	Oct. 2017
80.	University of California – Irvine	Nov. 2017
81.	UCLA (<i>Boehringer-Ingelheim Lecturer</i>)	Nov. 2017
82.	University of Pennsylvania (<i>Organic Reactions Lecturer</i>)	Nov. 2017
83.	Harvard University (<i>E. Bright Wilson Prize Lecturer</i>)	Feb. 2018
84.	College of Wooster	Feb. 2018
85.	Eli Lilly Grantee Symposium - Indianapolis, IN	Mar. 2018
86.	ACS National Meeting (<i>Photoredox in Organic Synthesis Symposium</i>) – New Orleans, LA	Mar. 2018
87.	ACS National Meeting (<i>Somorjai Award Symposium</i>) – New Orleans, LA	Mar. 2018
88.	University of Minnesota (<i>Millipore-Sigma Lecture</i>)	Apr. 2018
89.	French American Chemical Society Meeting - Orleans, France	June 2018
90.	3 rd International Conference on Proton-Coupled Electron Transfer – Blowing Rock, NC	June 2018
91.	ACS National Meeting (<i>Cope Scholar Award Symposium</i>) – Boston, MA	Aug. 2018
92.	Merck – West Point, PA	Sept. 2018
93.	ORCHEM Symposium (<i>Plenary Speaker</i>) Berlin, Germany	Sept. 2018

Robert R. Knowles, Ph.D.

94. ICIQ – Tarragona, Spain	Sept. 2018
95. NESACS Process Chemistry Symposium – Boston, MA	Oct. 2018
96. Waseda University – Tokyo, Japan	Oct. 2018
97. Mitsui Catalysis Award Symposium – Tokyo, Japan	Oct. 2018
98. Universal Display Corporation – Princeton, NJ	Oct. 2018
99. Boston College	Nov. 2018
100. Seoul National University – Seoul, South Korea	March 2019
101. KAIST – Daejeon, South Korea	March 2019
102. Dalhousie University – Halifax, Canada	April 2019
103. Novartis Early Career Award Symposium – Basel, Switzerland	June 2019
104. Pacific Symposium on Radical Chemistry – Monterrey, CA	July 2019
105. 26 th International Symposium in on Synthesis in Organic Chemistry – Cambridge UK	July 2019
106. 29 th International Conference on Photochemistry – Boulder, CO	July 2019
107. Merck – Boston, MA	Aug. 2019
108. McGill University – Montreal, Canada	Sep. 2019
109. Syngenta Symposium in One-Electron Chemistry - Stein, Switzerland (<i>Plenary Speaker</i>)	Oct. 2019
110. Firmenich - Geneva, Switzerland	Oct. 2019
111. Novartis – Basel, Switzerland	Oct. 2019
112. Celgene – Cambridge, MA	Nov. 2019
113. University of Sydney – Sydney, Australia	Dec. 2019
114. University of Melbourne – Melbourne, Australia	Dec. 2019
115. Flinders University – Adelaide, Australia	Dec. 2019
116. Murdoch University – Perth, Australia	Dec. 2019
117. Eric Jacobsen's 60 th Birthday Symposium – Harvard University	Feb. 2020