Clay S. Bennett
Tufts University Department of Chemistry
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EDUCATION

NIH Postdoctoral Fellow, The Scripps Research Institute
Research Advisor: Professor Chi-Huey Wong

Ph.D., 2005, The University of Pennsylvania, Organic Chemistry
Research Advisor: Professor Amos B. Smith, III
Thesis: "Synthetic Studies on the Spongistatin Family of Natural Products"

B.A. (cum laude), 1999, Connecticut College, ACS Chemistry

POSITIONS

Associate Professor of Chemistry, Tufts University, Department of Chemistry September 2015 - present.

Assistant Professor of Chemistry, Tufts University, Department of Chemistry September 2008 – August 2015.

Research Fellow, The Scripps Research Institute 2005-2008.

AWARDS

Ruth L. Kirschstein National Research Service Award (2005-2008)

PUBLICATIONS

FROM TUFTS UNIVERSITY

1) Lloyd, D.; Bylsma, M.; Bright, D. K.; Chen, X.; Bennett, C. S. "A Mild Method for 2-Naphthylmethyl Ether Protecting Group Removal Using a Combination of 2,3-Dichloro5,6-dicyano-1,4-benzoquinone (DDQ) and β-Pinene" *J. Org. Chem.* **2017**, *82*, 3926-3934.
2) Spradlin, J. N.; Lloyd, D.; Bennett, C. S. "A Convenient Synthesis of di-*O*-Acetyl-D-Rhanmal (di-*O*-Acetyl-6-Deoxy-Glucose)" *Carbohydrate Chemistry: Proven Synthetic Methods, vol. 4,* **2017**, *Accepted Manuscript*.
3) Nogueira, J.; Bylsma, M.; Bright, D. K.; Bennett, C. S. "Reagent Controlled α-Selective Dehydrative Glycosylations of 2,6-Dideoxy- and 2,3,6-Trideoxy-Sugars" *Angew. Chem. Int. Ed.* **2016**, *55*, 10088-10092
4) Bennett, C. S. "Dehydrative Glycosylation Methods" *Chemistry, Molecular Science and Chemical Engineering,* **2016**, doi:10.1016/B978-0-12-409547-2.11578-1.
5) Chu, A.-H. A.; Minciunescu, A.; Bennett, C. S. "Aryl(trifluoroethyl)iodonium Triflimide and Nitrile Solvent Systems: A Combination for the Stereoselective

Synthesis of Armed 1,2-trans--Glycosides at Noncryogenic Temperatures" *Org. Lett.* **2015**, *16*, 6262-6265.

6) Lloyd, D.; Bennett, C. S. "A Gram-Scale Synthesis of an Armed Colitose Thioglycoside." *J. Org. Chem.* **2014**, *79*, 9826-9829.

7) Liu, D.; Sarrafpour, S.; Guo, W.; Goulart, B.; Bennett, C. S. "Matched/Mismatched Interactions in Chiral Brønsted Acid Catalyzed Glycosylation Reactions with 2-Deoxy-Sugar Trichloroacetimidate Donors" *J. Carbohydr. Chem.* **2014**, *33*, 423-434.

8) Issa, J. P.; Bennett, C. S. "A Reagent Controlled S_N2-Glycosylation for the Direct Synthesis of β-Linked 2-Deoxy-Sugars" *J. Am. Chem. Soc.* **2014**, *136*, 5740-5744.

9) Chu, A.-H. A.; Minciunescu, A.; Montanari, V.; Kumar, K.; Bennett, C. S. "An Air- and Water-Stable Iodonium Salt Promoter for Facile Thioglycoside Activation" *Org. Lett.* **2014**, *16*, 1780-1782.

10) Bennett, C. S. "Principles of Modern Solid-Phase Oligosaccharide Synthesis" *Org. Biol. Mol. Chem.* **2014**, *12*, 1686-1698. (Invited Review)

11) Chu, A.-H. A.; Nguyen, S. H.; Sisel, J. A.; Minciunescu, A.; Bennett, C. S. "Selective Synthesis of 1,2-*cis*-α-Glycosides Without Directing Groups. Application to Iterative Oligosaccharide Synthesis." *Org. Lett.* **2013**, *15*, 2566-2569.

12) Issa, J. P.; Lloyd, D.; Steliotes, E.; Bennett, C. S**.** "Reagent Controlled β-Specific Dehydrative Glycosylation Reactions with 2-Deoxy-Sugars" *Org. Lett.* **2013***, 15,* 4170-4173.

13) Nogueira, J. M.; Issa, J. P.; Chu, A.-H. A.; Sisel, J. A.; Schum, R. S.; Bennett, C. S. "Halide Effects on Cyclopropenium Cation Promoted Dehydrative Glycosylation with Deoxy-Sugars: Highly α−Selective Glycosylations using a 3,3-Dibromo-1,2-diphenylcyclopropene Promoter" *Eur. J. Org. Chem.* **2012**, 4927-4930.

14) Bennett, C. S. "3,3-dichloro-1,2-diphenylcyclopropene, CAS No: 2570-00-5 (2102)" Encyclopedia of Reagents for Organic Synthesis [Online], John Wiley & Sons Ltd., http://onlinelibrary.wiley.com/book/10.1002/047084289X DOI: 10.1002/047084289X.r01514. (Invited Review)

15) Nguyen, S. H.; Trotta, A.; Cao. J.; Straub, T. J.; Bennett, C. S. "Direct *O*-Glycosidation of Resin Bound Thioglycosides" *Org. Biomol. Chem.* **2012**, *10*, 2373-2375.

16) Nogueira, J. M.; Nguyen, S. H.; Bennett, C. S**.** "Cyclopropenium Cation-Promoted Dehydrative Glycosylations Using 2-Deoxy and 2,6-Dideoxy-Sugars" *Org. Lett.* **2011**, *13*, 2814-2817.

FROM PREVIOUS POSITIONS

17) Smith, A. B., III; Risatti, C. A.; Atasoylu, O.; Bennett, C. S., Luis, J.; Cheng, H.; TenDyke, K.; Xu, Q. "Design, Synthesis and Biological Evaluation of Diminutive

Forms of (+)-Spongistatin 1: Lessons Learned" *J. Am. Chem. Soc.* **2011**, *133*, 14042-14053.

18) Smith, A. B., III; Risatti, C. A.; Atasoylu, O.; Bennett, C. S.; TenDyke, K.; Xu, Q. "Design, Synthesis, and Biological Evaluation of EF- and ABEF- Analogues of (+)-Spongistatin 1" *Org. Lett.* **2010**, *12*, 1792-1795.

19) Lewis, J. C.; Bastian, S; Bennett, C. S.; Fu, Y.; Mitsuda, Y.; Chen, M. M.; Greenberg, W. A.; Wong, C.-H.; Arnold, F. H. "Chemoenzymatic Elaboration of Monosaccharides Using Engineered Cytochrome $P450_{BM3}$ Demethylases" *Proc. Natl. Acad. USA* **2009***, 106*, 16550-16555.

20) Smith, A. B., III; Lin, Q.; Doughty, V. A.; Zhuang, L.; McBriar, M. D.; Kerns, J. K.; Boldi, A. M.; Murase, N.; Moser, W. H.; Brook, C. S.; Bennett, C. S.; Makayama, K.; Sobukawa, M.; Trout, R. E. L. "Spongipyran Synthetic Studies. Total Synthesis of (+)-Spongistatin 2" *Tetrahedron* **2009**, *65*, 6470-6588.

21) Smith, A. B., III; Sfouggatakis, C.; Risatti, C. A.; Sperry, J. B.; Zhu, W.; Doughty, V. A.; Tomioka, T.; Gotchev, D.; Bennett, C. S.; Sakamoto, S.; Atasoylu, O.; Shirakami, S.; Bauer. D.; Takeuchi, M.; Koyanagi, J.; Sakamoto, Y. "Spongipyran Synthetic Studies. Evolution of a Scalable Total Synthesis of (+)-Spongistatin 1" *Tetrahedron* **2009**, *65*, 6489-6509.

22) Bennett, C. S.; Payne, R. J.; Ficht, S.; Dean, S. M.; Brik, A.; Wong, C.-H. "Sugar-Assisted Glycopeptide Ligation with Complex Oligosaccharides: Scope and Limitations." *J. Am. Chem. Soc.* **2008**, *130*, 11945-11952.

23) Bennett, C. S.; Wong, C.-H. "Chemoenzymatic Approaches to Glycoprotein Synthesis" *Chem. Soc. Rev.* **2007**, *36*, 1227-1238.

24) Brik, A.; Ficht, S.; Yang, Y.-Y.; Bennett, C. S.; Wong, C.-H. "Sugar-Assisted Ligation (SAL) of *N*-Linked Glycopeptides with Broad Sequence Tolerance at the Ligation Junction" *J. Am. Chem. Soc.* **2006**, *128*, 15026-15033.

25) Liu, L.; Bennett, C. S., Wong, C.-H. "Advances in Glycoprotein Synthesis" *Chem. Commun.* **2006**, 21-33.

26) Smith, A. B., III; Zhu, W.; Shirakami, S.; Sfouggatakis, C.; Doughty, V. A.; Bennett, C. S.; Sakamoto, Y. "Total Synthesis of (+)-Spongistatin 1. An Effective Second-Generation Construction of an Advanced EF Wittig Salt, Fragment Union, and Final Deprotection" *Org. Lett.* **2003**, *5*, 761-764.

27) Smith, A. B., III; Doughty, V. A.; Sfouggatakis, C.; Bennett, C. S.; Koyanagi, J.; Takeuchi, M. "Spongistatin Synthetic Studies. An Efficient, Second-Generation Construction of an Advanced ABCD Intermediate" *Org. Lett.* **2002**, *4*, 783-786.

BOOK CHAPTERS

Bennett, C. S.; Payne, R. J.; Koeller, K. M.; Wong, C.-H. "Synthesis and Applications of Biologically Relevant Glycopeptides." in *Glycosciences*, 2nd ed.; Thiem, J., Fraser-Reid, B. O., Tatsuta, K.; Springer-Verlag: Berlin. 2008; vol. 2, pp. 1795-1859.

BOOKS

Selective Glycosylations: Synthetic Methods and Catalysts; Bennett, C. S. ed.; Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, 2017

PATENTS

1) Arnold, F. H.; Wong, C.-H. Mitsuda, Y.; Chen, M. M.; Bennett, C. S.; Greenberg, W. A.; Lewis, J. C.; Bastian, S. "Engineered Bacterial Cytochrome P450 Variants for Preparation of Selectively Protected Carbohydrates" USP 20090124515, **2009**.

2) Bennett, C. S.; Chu, A.-H. A. "Stereoselective Glycosylation Reactions" USP 9359394 **2016**

3) Bennett, C. S.; Issa, J. P.; Lloyd, D. "Reagent Controlled Stereoselective Glycosylation" USP 9403862 **2016**

4) Bennett, C. S.; Chu, A.-H. A. "Glycosylation Using Aryl(trifluoroethyl)iodonium Salts" USP 9422325 **2016**

INVITED ORAL PRESENTATIONS

1) "Chemical Promoters for Controlling Selectivity in Glycosylation Reactions" 254th ACS National Meeting, Frontiers in Carbohydrate Synthesis Symposium – Washington DC, August 21st, 2017.

2)"Chemical Promoters for Controlling Selectivity in Glycosylation Reactions" Gordon Research Conference on Carbohydrates - Mt. Snow, VT, June 26, 2017.

3)"Chemical Promoters for Controlling the Selectivity of Glycosylation Reactions: Progress Towards and Oligosaccharide Synthesis" Boston Glycobiology Discussion Group – Boston University School of Medicine, Boston, MA, March 8, 2017,

4)"The Use of Reagent Control in Stereoselective Glycosylation Reactions" 21st IUPAC International Conference on Organic Synthesis – Mumbai, India, December 13, 2016.

5)"Reagent Controlled Approaches to Stereoselective Glycosylation Reactions" – Colgate University, Hamilton, NY, September 26, 2016.

6)"Reagent Control in Diastereoselective Glycosylation Reactions" Mapping the Human Glycome in Health and Disease Workshop at the Radcliffe Institute for Advanced Study - Cambridge, MA, September 15, 2016.

7) "Towards Glycosylation Chemistries for the non-Expert" – Tsing Hua University, Taiwan, January 29, 2016.

8)"Cyclopropenium Cation Promoted Dehydrative Glycosylation" – Taiwan University, Taiwan. January 28, 2016.

9) "The Evolution of a β-Specific Approach to Deoxy-Sugar Oligosaccharide Construction" – Genomics Research Center, Academia Sinica, Taiwan, January 26, 2016

10) "Reagent Controlled Approaches to Deoxy-Sugar Oligosaccharides" 250th ACS National Meeting, Carbohydrate Synthesis for Medicinal Chemistry and Biology Symposium – Boston, MA, August 18th, 2015.

11) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" – Rutgers University - New Brunswick, NJ. April 3, 2015.

12) "From Solvent Effects to Reagent Control: Stereoselective Approaches to Glycosylation Reactions without Directing Groups." South African Chemical Institute and American Chemical Society Binational Organic Chemistry Conference. - Stellenbosch, South Africa, December 1, 2014.

13) "From Solvent Effects to Reagent Control: Stereoselective Approaches to Glycosylation Reactions without Directing Groups." Chemical Aspects of Glycobiology Satellite Symposium at the 2014 Society for Glycobiology/ Japanese Society of Carbohydrate Research joint meeting - Honolulu, HI, November 16, 2014.

14) "Reagent Controlled Approaches to Stereoselective Glycoside Synthesis" - University of California, Irvine, October 15, 2014.

15) "Reagent Controlled Stereoselective Synthesis of 2-Deoxy-Sugars" - 97th Canadian Chemistry Conference and Exposition, Vancouver, British Columbia, June 5, 2014

16) "Reagent Control in Diastereoselective Glycosylation Reactions" – Perkin Elmer, Boston, MA, May 14, 2014.

17) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" – Northeastern University, Boston, MA, April 24, 2014.

18) "Reagent Controlled Stereoselective Glycosylation Reactions" – University of Missouri - St. Louis, MO, April 14, 2014.

19) "Reagent Controlled Stereoselective Glycosylation Reactions" – University of Southern Illinois - Edwardsville, IL, April 14, 2014.

20) "Reagent Control in Diastereoselective Chemical Glycosylation Reactions" 247th ACS National Meeting, New Directions in Carbohydrate Synthesis Symposium – Dallas, TX March 17, 2014.

21) "Facile Glycosylation Reactions using Air- and Water-Stable Iodonium Salt Promoters" 247th ACS National Meeting, Young Investigators in Glycoscience Symposium – Dallas, TX March 17, 2014.

22) "Reagent Controlled Approaches to Stereoselective Glycosylation Reactions" - Bowdoin College, February 28, 2014.

23) "Reagent Controlled Stereoselective and Stereospecific Glycosylation Reactions" -University of Pittsburgh, February 20, 2014.

24) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" Indiana University - Bloomington, January 27, 2014.

25) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" - University of Iowa, November 14, 2013.

26) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" - Iowa State University, November 15, 2013.

27) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" - Bates College, November 6, 2013.

28) "Reagent Control as a Guiding Principle in Chemical Glycosylation Reactions" - Brown University, October 25, 2013.

29) "Reagent Controlled Approaches to Stereoselective Glycosylation Reactions" Brandeis University October 14, 2013.-

30) "Reagent Controlled Stereoselective Glycosylations Using 2-Deoxy-Sugars" 9th Annual Midwest Carbohydrate and Glycobiology Symposium - Toledo, OH, October 12, 2013.

31) "Rationally Designed Promoters for Reagent Controlled Chemical Glycosylations" - The University of Alberta, October 7, 2013.

32) "Reagent Controlled Chemical Glycosylations" Gordon Research Conference on Carbohydrates - Mt. Snow, VT, June 17, 2013.

33) "Highly Stereoselective Glycosylation Reactions Using Shelf-Stable Donors: Towards Glycosylation as an S_N2 Reaction" - University of Massachusetts Dartmouth, March 6, 2013.

34) "Development of Enabling Tools for the Glycoscientist" - Connecticut College, March 31, 2009.

OTHER PRESENTATIONS

1) "A Practical Next-Generation Controlled Approach to β-Linked Deoxy-Sugars: Application Toward Oligosaccharide Synthesis" 5th Annual Boston Symposium on Organic and Bioorganic Chemistry, Boston, MA, October 19, 2016 (Presented by graduate student Dina Lloyd).

2) "Reagent controlled dehydrative glycosylations of 2-deoxy sugars: Toward construction of α-linked 2-deoxy-containing carbohydrate structures" 3rd Annual Boston Symposium on Organic and Bioorganic Chemistry, Boston, MA, October 8, 2014 (Presented by graduate student Jason Nogueira).

3) "Water/Air-Stable Iodonium Salt as a Powerful Thiophilic Promoter" 3rd Annual Boston Symposium on Organic and Bioorganic Chemistry, Boston, MA, October 8, 2014 (Presented by graduate student An-Hsiang Adam Chu).

4)"Towards the Total Synthesis of *Escherichia coli* O-*a*ntigen O111 Minimum Repeat Unit" 248th ACS National Meeting, San Francisco, CA, August 2014 (Presented by Graduate Student Dina Lloyd

5)"A Reagent-Controlled S_N2-Glycosylation for the Direct Synthesis of β-Linked 2-Deoxy-Sugars" 248th ACS National Meeting, San Francisco, CA, August 2014 (Presented by Graduate Student John Paul Issa).

6)"Water/air-Stable Iodonium Salts as Powerful Thiophilic Promoter" 247th ACS National Meeting, Dallas, TX, March 17th, 2014. (Presented by graduate student An-Hsiang Adam Chu).

7)"Selective Synthesis of 1,2-*cis*-α-Glycosides Without Directing Groups" Boston Symposium on Organic and Bioorganic Chemistry – Boston MA, October 2013 (Presented by Graduate Students An-Hsiang Adam Chu and Dina Lloyd).

8)"N-sulfonyl Imidazoles as Promoters for β-Specific Dehydrative Glycosylation Reactions with Deoxy-Sugars" 246th ACS National Meeting – Indianapolis, IN, September 2013 (Presented by graduate student John Paul Issa).

9)"Development of Carbohydrate-Adjuvant Conjugates as Defined *S. pneumonia* Vaccines" ACS National Meeting – 246th Indianapolis, IN, September 2013 (Presented by graduate student Son Hong Nguyen).

10) "Cyclopropenium Cation Mediated Glycosylation with 2-Deoxy-Sugars for α-Selective Glycosylations" 245th ACS National Meeting – New Orleans, LA, April 2013 (presented by graduate student J. Nogueira).

11) "Highly Stereoselective *cis*-1,2-Glycosylations using Thioglycoside Donors in the Absence of Directing Groups" 245th ACS National Meeting – New Orleans, LA, April 2013 (presented by graduate student An-Hsiang Adam Chu).

12) "Toward Diastereoselective Glycosylation Reactions Using Reagent Control" Boston Symposium on Organic and Bioorganic Chemistry – Boston MA, October 2012 (Presented by Graduate Students John Paul Issa and Jason Nogueira).

13) "Second-Generation Cyclopropenium Cation Promoters for Highly α-Selective Dehydrative Glycosylations with 2-Deoxy-Sugar donors" 244th ACS National Meeting –Philadelphia, PA 2012.

14) "Cyclopropenium Promoted Glycosylation Reactions with 2-Deoxy-Sugars" Gordon Research Conference on Carbohydrates, Colby College, June 6, 2011.

15) "Chiral Promoters to Control the Stereochemical Outcome of Glycosylation Reactions" Gordon Research Conference on Organic Reactions and Processes, Bryant University, July 18, 2010.

16) "Chiral Promoters to Control the Stereochemical Outcome of Glycosylation Reactions" 240th ACS National Meeting - Boston, MA 2010.

SERVICE-PROFESSIONAL

REVIEWER FOR JOURNALS:

ACS Medicinal Chemistry Letters, Analytical Chemistry, Angewandte Chemie, Bioorganic & Medicinal Chemistry, Carbohydrate Research, Chemical Communications, Chemical Science, Chemical Society Reviews, ChemMedChem, Journal of Carbohydrate Chemistry, Journal of the American Chemical Society, Journal of Organic Chemistry, Nature Chemistry, Organic Letters, RSC Advances, and Tetrahedron Letters.

REVIEWER FOR PROPOSALS:

- ACS Petroleum Research Fund
- Louisiana Board of Regents Research Competitiveness Program
- National Institutes of Health - Synthetic and Biological Chemistry A (*ad hoc member*)
- NTU Tier 1 Grant Program (Nanyang Technological University, Singapore)
- European Research Council Tier 1 Consolidator Grant
- National Institutes of Health – Glycoscience Common Fund - Data Integration and Analysis Tools: Accessible Resources for Integration and Analysis of Carbohydrate and Glycoconjugate Data in the Context of Comparable Gene, Protein, and Lipid Data (U01)
- National Institutes of Health – Glycoscience Common Fund - Facile Methods and Technologies for Synthesis of Biomedically Relevant Carbohydrates (U01)

EXTERNAL Ph.D. REVIEWER:

- Brandeis University
- The University of Johannesburg
- University of Cape Town

CONFERENCES ORGANIZED

- 1st Annual New England Glyco-Chemistry Meeting, Boston, MA, June 23rd 2017.