Carolyn R. Bertozzi

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Chemical & Systems Biology and Radiology
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Professional Positions

Baker Family Director, Stanford ChEM-H	2018 – present
Anne T. and Robert M. Bass Professor of Chemistry, Professor of Chemical & Systems Biology and Radiology (by courtesy) Stanford University	2015 – present
Howard Hughes Medical Institute Investigator	2000 – present
T. Z. and Irmgard Chu Distinguished Professor of Chemistry, UC Berkeley	2004 - 2015
Professor of Chemistry and Molecular and Cell Biology, UC Berkeley	2002 - 2015
Professor of Molecular and Cellular Pharmacology, UCSF	2000 - 2015
Senior Faculty Scientist, Lawrence Berkeley National Laboratory	2007 - 2015
Associate Professor of Chemistry and Molecular and Cell Biology, UC Berkeley	1999 - 2002
Assistant Professor of Chemistry, UC Berkeley	1996 - 1999

Education

American Cancer Society Postdoctoral Fellow with Prof. Steven Rosen, UCSF	1993 - 1995
Ph.D. in Chemistry with Prof. Mark Bednarski, UC Berkeley	1988 - 1993
ACS Medicinal Chemistry Graduate Fellowship (1991-1992)	
Office of Naval Research Graduate Fellowship (1988-1991)	
AT&T Bell Laboratories Graduate Fellowship (1988-1993)	
A.B. in Chemistry, *summa cum laude*, Harvard University	1984 - 1988
Radcliffe Science Research Fellowship (1987)	

Academy Memberships

Foreign Member of the Royal Society (2018); National Academy of Inventors (2013); National Academy of Medicine (2011); German Academy of Sciences Leopoldina (2008); National Academy of Sciences (2005); American Academy of Arts and Sciences (2003)

Honorary Doctorate Degrees

University of York (2020)
Duke University (2014)
Freie Univ. Berlin (2014)
Brown University (2012)

Major Awards

President's Innovator Award, Society for Glycobiology (2020); Nagoya Medal (2020); Chemistry for the Future Solvay Prize (2020); National Academy of Sciences John J. Carty Award for the Advancement of Science (2020); Glenn T. Seaborg Medal, UCLA (2020); F.A. Cotton Medal, Texas A&M University (2020); The Gustavus John Esselen Award for Chemistry in the Public Interest, Northeast Section of the ACS (2019); Max Tishler Prize, Harvard University Dept. of Chemistry (2018); National Inventor's Hall of Fame Inductee (2017); American Chemical Society Arthur C. Cope Award (2017); National Academy of Sciences Award in the Chemical Sciences (2016); Ernest Orlando Lawrence Award of the U.S. Department of Energy (2015); UCSF 150th Anniversary Alumni Excellence Award (2015); Hans Bloemendal Award (Radboud Univ. Nijmegen) (2013); Heinrich Wieland Prize (2012); Tetrahedron Young Investigator Award (2011); Lemelson-MIT Prize (2010); Albert Hofmann Medal (Univ. Zurich) (2009); Harrison Howe Award (2009); W. H. Nichols Award (2009); Willard Gibbs Medal (2008); Roy L. Whistler International Award in Carbohydrate Chemistry (2008); Li Ka Shing Women in Science Award (2008); Ernst Schering Prize (2007); T.Z. and Irmgard Chu Distinguished Professorship in Chemistry (2005); Havinga Medal, Univ. Leiden (2005); Iota Sigma Pi Agnes Fay Morgan Research Award (2004); Irving Sigal Young Investigator Award of the Protein Society (2002); Fellow of the American Association for the Advancement of Science (2002); Donald Sterling Noyce Prize for Excellence in Undergraduate Teaching (2001); UC Berkeley Distinguished Teaching Award (2001); ACS Award in Pure Chemistry (2001); Merck Academic Development Program Award (2000); UC Berkeley Department of Chemistry Teaching Award (2000); Presidential Early Career Award in Science and Engineering (PECASE) (2000); MacArthur Foundation "Genius" Award (1999); Camille Dreyfus Teacher-Scholar Award (1999); Arthur C. Cope Scholar Award (ACS) (1999); Beckman Young Investigator Award (1998); Prytanean Faculty Award (1998); Glaxo Wellcome Scholar (1998); Research Corporation Research Innovation Award (1998); Office of Naval Research Young Investigator Award (1998); Horace S. Isbell Award in Carbohydrate Chemistry (ACS) (1997); Alfred P. Sloan Research Fellow (1997); Burroughs Wellcome New Investigator Award in Pharmacology (1997); Pew Scholars Award in the Biomedical Sciences (1996); Exxon Education Fund Young Investigator Award (1996); Camille and Henry Dreyfus New Faculty Award (1995)

Other Major Activities

Board memberships:
Jupiter Therapeutics Scientific Advisory Board (2018 – present)
Mekonos Scientific Advisory Board (2018 – present)
Ono Pharmaceuticals Science Advisory Board (2017–present)
Elysium Health Scientific Advisory Board (2017 – present)
Glenn Foundation Advisory Board (2017 – present)
Grace Science Foundation Advisory Board (2015 – present)
Eli Lilly Board of Directors (Science & Technology and Public Policy & Compliance Committees) (2017 – 2021)
Broad Institute Board of Scientific Counselors (2009 – 2017)
Glaxo SmithKline Research Advisory Board (2009 – 2017)

Companies co-founded:
Co-founder and SAB Chair, Lycia Therapeutics (2019-present)
Co-founder, OliLux Biosciences (2019-present)
Co-founder and SAB Chair, InterVenn Bio (2018-present)
Co-founder, Grace Science LLC (2018-present)
Co-founder, Palleon Pharmaceuticals (2016-present)

Co-founder, Enable Biosciences (2015-present)
Co-founder and SAB Chair, Redwood Bioscience (acquired by Catalent) (2008-present)
Co-founder and SAB Chair, Thios Pharmaceuticals (1999-2004)

Other leadership positions:
Director, ChEM-H Chemistry/Biology Interface Predoctoral Training Program (2015 – present)
Co-Director, Berkeley Nanosciences and Nanoengineering Institute (BNNI) (2011 – 2015)
Co-Director, UC Berkeley Chemical Biology Graduate Program (2001 – 2015)
NIH/NIGMS Advisory Council Member (2008 – 2012)
Berkeley Nanoscience and Nanotechnology Initiative Executive Committee (2007 – 2011)
Director, The Molecular Foundry, Lawrence Berkeley National Laboratory (2006 – 2010)

Editor-in-chief positions:
Editor-in-Chief, *ACS Central Science* (2014 – present)
Co-Editor-in-Chief, *Current Opinion in Chemical Biology* (2005 – 2010)

Editorial Boards:
Editorial Board Member, *Cell* (2009-2012), *Accounts of Chemical Research* (2000-present), *Carbohydrate Research* (2000-present), *Cell Chem. Biol*. (2004-present)
Editorial Advisory Board, *Integrative Biology* (2010-present), *Curr. Opin. Chem. Biol*. (2010-present), *ACS Chemical Biology* (2006-present), *ACS Nano* (2008-present), *J. Org. Chem*. (2001-2005)
Board of Consulting Editors for *Bioorg. Med. Chem.* and *Bioorg. Med. Chem. Lett.*
Honorary Editorial Board Member, *Synlett* (1999-present), *Perspectives in Medicinal Chemistry* (2006-present), *Topics in Stereochemistry* (2007-present)

Publications

1. Chidsey, C. E. D.; Bertozzi, C. R.; Putvinski, T. M.; Mujsce, A. M. Coadsorption of Ferrocene-Terminated and Unsubstituted Alkanethiols on Gold: Electroactive Self-Assembled Monolayers. *J. Am. Chem. Soc.* **1990**, *112*, 4301-4306.

2. Bertozzi, C. R.; Bednarski, M. D. The Synthesis of Heterobifunctional Linkers for the Conjugation of Ligands to Molecular Probes. *J. Org. Chem.* **1991**, *56*, 4326-4329.

3. Bertozzi, C. R.; Bednarski, M. D. *C*-Glycosyl Compounds Bind to Receptors on the Surface of *Escherichia coli* and can Target Proteins to the Organism. *Carbohydrate Res.* **1992**, *223*, 243-253.

4. Kobertz, W. R.; Bertozzi, C. R.; Bednarski, M. D. An Efficient Method for the Synthesis of α- and β-*C*-Glycosyl Aldehydes. *Tetrahedron Lett.* **1992**, *33*, 737-740.

5. Bertozzi, C. R.; Bednarski, M. D. Antibody Targeting to Bacterial Cells Using Receptor-Specific Ligands. *J. Am. Chem. Soc.* **1992**, *114*, 2242-2245.

6. Bertozzi, C. R.; Bednarski, M. D. A Receptor-Mediated Immune Response Using Synthetic Glycoconjugates. *J. Am. Chem. Soc.* **1992**, *114*, 5543-5546.

7. Bertozzi, C. R.; Bednarski, M. D. The Synthesis of 2-Azido *C*-Glycosyl Sugars. *Tetrahedron Lett.* **1992**, *33*, 3109-3112.

8. Bertozzi, C. R.; Hoeprich, P. D., Jr.; Bednarski, M. D. The Synthesis of Carbon-Linked Glycopeptides as Stable Glycopeptide Models. *J. Org. Chem.* **1992**, *57*, 6092-6094.

9. Bertozzi, C. R.; Cook, D. G.; Kobertz, W. R.; Gonzalez-Scarano, F.; Bednarski, M. D. Carbon-Linked Galactosphingolipid Analogs Bind Specifically to HIV-1 gp120. *J. Am. Chem. Soc.* **1992**, *114*, 10639-10641.

10. Grabowski, J. J.; Bertozzi, C. R.; Jacobsen, J. R.; Jain, A.; Marzluff, E. M.; Suh, A. Y. Fluorescence Probes in Biochemistry: An Examination of the Non-Fluorescent Behavior of Dansylamide by Photoacoustic Calorimetry. *Analytical Biochem.* **1992**, *207*, 214-226.

11. Hemmerich, S.; Bertozzi, C. R.; Leffler, H.; Rosen, S. D. Identification of the Sulfated Monosaccharides of GlyCAM-1, an Endothelial-Derived Ligand for L-Selectin. *Biochemistry* **1994**, *33*, 4820-4829.

12. Rosen, S. D.; Bertozzi, C. R. The Selectins and Their Ligands. *Curr. Opin. Cell Biol.* **1994**, *6*, 663-673.

13. Manning, D. D.; Bertozzi, C. R.; Pohl, N. L.; Rosen, S. D.; Kiessling, L. L. Selectin-Saccharide Interactions: Revealing Structure-Activity Relationships with Total Synthesis. *J. Org. Chem.* **1995**, *60*, 6254-6255.

14. Bertozzi, C. R.; Fukuda, S.; Rosen, S. D. Sulfated Disaccharide Inhibitors of L-selectin: Deriving Structural Leads from a Physiological Selectin Ligand. *Biochemistry* **1995**, *34*, 14271-14278.

15. Bertozzi, C. R. Cracking the Carbohydrate Code for Selectin Recognition. *Chem. Biol.* **1995**, *2*, 703-708.

16. Bertozzi, C. R.; Bednarski, M. D. "Synthesis of *C*-Glycosides: Stable Mimics of *O*-Glycosidic Linkages" in *Modern Methods in Carbohydrate Synthesis*. (1996) Harwood Academic Publishers, Gmbh, pp 316-351.

17. Kobertz, W. R.; Bertozzi, C. R.; Bednarski, M. D. *C*-Glycosyl Aldehydes: Synthons for *C*-linked Disaccharides. *J. Org. Chem.* **1996**, *61*, 1894-1897.

18. Rosen, S. D.; Bertozzi, C. R. Leukocyte Adhesion: Two Selectins Converge on Sulphate. *Curr. Biol.* **1996**, *6*, 261-264.

19. Manning, D. D.; Bertozzi, C. R.; Rosen, S. D.; Kiessling, L. L. Tin Mediated Phosphorylation: Synthesis and Selectin Binding of a Phospho Lewis a Analog. *Tetrahedron Lett.* **1996**, *37*, 1953-1956.

20. Roe, B. A.; Boojamra, D. G.; Griggs, J.; Bertozzi, C. R. Synthesis of b-*C*-Glycosides of *N*-acetylglucosamine via Keck Allylation Directed by Neighboring Phthalimide Groups. *J. Org. Chem.* **1996**, *61*, 6442-6445.

21. Sanders, W. J.; Katsumoto, T. R.; Bertozzi, C. R.; Rosen, S. D.; Kiessling, L. L. L-Selectin-Carbohydrate Interactions: An Investigation into the Relevant Modifications of the Lewis x Trisaccharide. *Biochemistry* **1996**, *35*, 14862-14867.

22. Bertozzi, C. R.; Singer, M. S.; Rosen, S. D. An ELISA for Selectin Inhibitors Based on Binding to a Physiological Ligand. *J. Immunol. Meth.* **1997**, *203*, 157-165.

23. Mahal, L. K.; Yarema, K. J.; Bertozzi, C. R. Engineering Chemical Reactivity on Cell Surfaces Through Oligosaccharide Biosynthesis. *Science* **1997**, *276*, 1125-1128.

24. Mahal, L. K.; Bertozzi, C. R. Engineered Cell Surfaces: Fertile Ground for Molecular Landscaping. *Chem. Biol.* **1997**, *4*, 415-422.

25. Rodriguez, E. C.; Winans, K. A.; King, D. S.; Bertozzi, C. R. A Strategy for the Chemoselective Synthesis of O-Linked Glycopeptides with Native Sugar-Peptide Linkages. *J. Am. Chem. Soc.* **1997**, *119*, 9905-9906.

26. Yarema, K. J.; Bertozzi, C. R. Chemical Approaches to Glycobiology and Emerging Carbohydrate-Based Therapeutic Agents. *Curr. Opin. Chem. Biol.* **1998**, *2*, 49-61.

27. Lemieux, G. A.; Bertozzi, C. R. Chemoselective Ligation Reactions with Proteins, Oligosaccharides and Cells. *Trends Biotech.* **1998**, *16*, 506-513.

28. Bowman, K. G.; Hemmerich, S.; Bhakta, S.; Singer, M. S.; Rosen, S. D.; Bertozzi, C. R. Identification of an *N*-Acetylglucosamine-6-O-Sulfotransferase Activity Restricted to Lymphoid Tissue: An Enzyme with a Possible Role in Lymphocyte Homing. *Chem. Biol.* **1998**, *5*, 447-460.

29. Marcaurelle, L. A.; Bertozzi, C. R. Direct Incorporation of Unprotected Ketone Groups into Peptides During Solid-Phase Synthesis: Application to the One-Step Synthesis of Peptides with Two Different Biophysical Probes. *Tetrahedron Lett.* **1998**, *39*, 7279-7282.

30. Rodriguez, E. C.; Marcaurelle, L. A.; Bertozzi, C. R. Aminooxy, Hydrazide and Thiosemicarbazide-Functionalized Saccharides: Versatile Reagents for Glycoconjugate Synthesis. *J. Org. Chem*. **1998**, *63*, 7134-7135.

31. Marcaurelle, L. A.; Rodriguez, E. C.; Bertozzi, C. R. Synthesis of an Oxime-Linked Neoglycopeptide with Glycosylation-Dependent Activity Similar to its Native Counterpart. *Tetrahedron Lett*. **1998**, *39*, 8417-8420.

32. Yarema, K. J.; Mahal, L. K.; Bruehl, R.; Rodriguez, E. C.; Bertozzi, C. R. Metabolic Delivery of Ketone Groups to Sialic Acid Residues. Application to Cell Surface Glycoform Engineering. *J. Biol. Chem.* **1998**, *273*, 31168-31179.

33. Winans, K. A.; Bertozzi, C. R. Inner Space Exploration: The Chemical Biologist's Guide to the Cell. *Chem. Biol.* **1998**, *5*, R313-R315.

34. Bowman, K. G.; Bertozzi, C. R. Carbohydrate Sulfotransferases: Mediators of Extracellular Communication. *Chem. Biol.* **1999**, *6*, R9-R22.

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36. Marcaurelle, L. A.; Bertozzi, C. R. New Directions in the Synthesis of Glycopeptide Mimetics. *Chem. Eur. J.* **1999**, *5*, 1384-1390.

37. Lemieux, G. A.; Yarema, K. J.; Jacobs, C. L.; Bertozzi, C. R. Exploiting Differences in Sialoside Expression for Selective Targeting of MRI Contrast Reagents. *J. Am. Chem. Soc.* **1999**, *121*, 4278-4279.

38. Lee, J. H.; Baker, T. J.; Mahal, L. K.; Zabner, J.; Bertozzi, C. R.; Wiemer, D. F.; Welsh, M. J. Engineering Novel Cell Surface Receptors for Virus-Mediated Gene Transfer. *J. Biol. Chem.* **1999**, *274*, 21878-21884.

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40. Mahal, L. K.; Yarema, K. J.; Lemieux, G. A.; Bertozzi, C. R. Chemical Approaches to Glycobiology: Engineering Cell Surface Sialic Acids for Tumor Targeting, in *Sialobiology and Other Novel Forms of Glycosylation*, Inoue, Y.; Lee, Y. C.; Troy, F. A., III, eds. Gakushin Publishing Company: Osaka, **1999**, pp. 237-280.

41. Shin, Y.; Winans, K. A.; Backes, B. J.; Kent, S. B. H.; Ellman, J. A.; Bertozzi, C. R. Fmoc-Based Synthesis of Peptide-^{a}Thioesters: Application to the Total Chemical Synthesis of a Glycoprotein by Native Chemical Ligation. *J. Am. Chem. Soc.* **1999**, *121*, 11684-11689.

42. Kehoe, J. W.; Bertozzi, C. R. Tyrosine Sulfation: A Modulator of Extracellular Protein-Protein Interactions. *Chemistry & Biology*, **2000**, *7*, R57-R61.

43. Armstrong, J. I.; Portley, A. R.; Chang, Y.-T.; Nierengarten, D. M.; Cook, B. N.; Bowman, K. G.; Bishop, A.; Gray, N. S.; Shokat, K. M.; Schultz, P. G.; Bertozzi, C. R. Discovery of Carbohydrate Sulfotransferase Inhibitors from a Kinase-Directed Library. *Angew. Chem. Int. Ed. Engl.* **2000**, *39*, 1303-1306.

44. Saxon, E.; Bertozzi, C. R. Cell Surface Engineering by a Modified Staudinger Reaction. *Science* **2000**, *287*, 2007-2010.

45. Saxon, E.; Armstrong, J. I.; Bertozzi, C. R. A "Traceless" Staudinger Ligation for the Chemoselective Synthesis of Amide Bonds. *Org. Lett*. **2000**, *2*, 2141-2143.

46. Jacobs, C. J.; Yarema, K. J.; Mahal, L. K.; Nauman, D. A.; Charters, N.; Bertozzi, C. R. Metabolic Labeling of Glycoproteins with Chemical Tags through Unnatural Sialic Acid Biosynthesis. *Meth. Enzymol.* **2000**, *327*, 260-275.

47. Charter, N. W.; Mahal, L. K.; Koshland, D. E., Jr.; Bertozzi, C. R. Biosynthetic Incorporation of Unnatural Sialic Acids into Polysialic Acid on Neural Cells. *Glycobiology*, **2000**, *10*, 1-8.

48. Armstrong, J. I.; Bertozzi, C. R. Sulfotransferases as Targets for Therapeutic Intervention. *Curr. Opin. Drug Disc. Dev.* **2000**, *3*, 502-515.

49. Cook, B. N.; Bhakta, S.; Biegel, T.; Bowman, K. G.; Armstrong, J. I.; Hemmerich, S.; Bertozzi, C. R. Differential Carbohydrate Recognition of Two GlcNAc-6-

Sulfotransferases with Possible Roles in L-Selectin Ligand Biosynthesis. *J. Am. Chem. Soc.* **2000**, *122*, 8612-8622.

50. Macmillan, D.; Bertozzi, C. R. New Directions in Glycoprotein Engineering. *Tetrahedron* **2000**, *56*, 9515-9525.

51. Bhakta, S.; Bartes, A.; Bowman, K. G.; Kao, W.-M.; Polsky, I.; Lee, J. K.; Cook, B. N.; Bruehl, R.; Rosen, S. D.; Bertozzi, C. R.; Hemmerich, S. Sulfation of *N*-Acetylglucosamine by Chondroitin 6-Sulfotransferase 2 (GST5). *J. Biol. Chem.* **2000**, *275*, 40226-40234.

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53. Bowman, K. G.; Cook, B. N.; de Graffenried, C. L.; Bertozzi, C. R. Biosynthesis of L-selectin Ligands: Sulfation of Sialyl Lewis x-Related Oligosaccharides by a Family of GlcNAc-6-Sulfotransferases. *Biochemistry* **2001**, *40*, 5382-5391.

54. Hang, H. C., Bertozzi, C. R. Ketone Isosteres of 2-*N*-Acetamido Sugars as Substrates for Metabolic Cell Surface Engineering. *J. Am. Chem. Soc.* **2001**, *123*, 1242-1243.

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56. Marcaurelle, L. A.; Bertozzi, C. R. Chemoselective Elaboration of *O*-Linked Glycopeptide Mimetics by Alkylation of 3-ThioGalNAc. *J. Am. Chem. Soc.* **2001**, *123*, 1587-1595.

57. Bertozzi, C. R.; Kiessling, L. L. Chemical Glycobiology. *Science* **2001**, *291*, 2357-2364.

58. Lemieux, G. A.; Bertozzi, C. R. Modulating Cell Surface Immunoreactivity by Metabolic Induction of Unnatural Carbohydrate Antigens. *Chem. Biol*. **2001**, *8*, 265-275.

59. Yarema, K. J.; Bertozzi, C. R. Characterizing Glycosylation Pathways. *Genome Biology* **2001**, *2*, 0004.1-0004.10.

60. Yarema, K. J.; Goon, S.; Bertozzi, C. R. Metabolic Selection of Glycosylation Defects in Human Cells. *Nature Biotechnol.* **2001**, *19*, 553-558.

61. Groves, J. T.; Mahal, L. K.; Bertozzi, C. R. Control of Cell Adhesion and Growth with Micropatterned Supported Lipid Membranes. *Langmuir* **2001**, *17*, 5129-5133.

62. Hang, H. C.; Bertozzi, C. R. Chemoselective Approaches to Glycoprotein Engineering. *Acc. Chem. Res*. **2001**, *34*, 727-736.

63. Verdugo, D. E.; Cancilla, M. T.; Ge, X.; Gray, N. S.; Chang, Y.-T.; Schultz, P. G.; Negishi, M.; Leary, J. A.; Bertozzi, C. R. Discovery of Estrogen Sulfotransferase Inhibitors from a Purine Library Screen. *J. Med. Chem*., **2001**, *44*, 2683-2686.

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66. Schilling, B.; Goon, S.; Samuels, N. M.; Gaucher, S. P.; Leary, J. A.; Bertozzi, C. R.; Gibson, B. W. Biosynthesis of Sialylated Lipooligosaccharides in *Haemophilus ducreyi* is Dependent on Exogenous Sialic Acid and not Mannosamine. *Biochemistry* **2001**, *40*, 12666-12677.

67. Saxon, E.; Bertozzi, C. R. Chemical and Biological Strategies for Engineering Cell Surface Glycosylation. *Ann. Rev. Cell Dev. Biol*. **2001**, *17*, 1-23.

68. Jacobs, C. L.; Goon, S.; Yarema, K. J.; Hinderlich, S.; Hang, H. C.; Chai, D. H.; Bertozzi, C. R. Substrate Specificity of the Sialic Acid Biosynthetic Pathway. *Biochemistry* **2001**, *40*, 12864-12874.

69. Mahal, L. K.; Charter, N. W.; Angata, K.; Fukuda, M.; Koshland, D. E., Jr.; Bertozzi, C. R. A Small Molecule Modulator of Poly-α2,8-Sialic Acid Expression on Cultured Neurons and Tumor Cells. *Science* **2001**, *294*, 380-382.

70. Marcaurelle, L. A.; Shin, Y.; Goon, S.; Bertozzi, C. R. Synthesis of Oxime-linked Mucin Mimics Containing the Tumor-related T_N and Sialyl T_N Antigens. *Org. Lett*. **2001**, *3*, 3691-3694.

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73. Kehoe, J. W.; Maly, D. J.; Verdugo, D. E.; Armstrong, J. I.; Cook, B. N.; Ouyang, Y.-B.; Moore, K. L.; Ellman, J. E.; Bertozzi, C. R. Tyrosylprotein Sulfotransferase Inhibitors Generated by Combinatorial Target-Guided Ligand Assembly. *Bioorg. Med. Chem. Lett.* **2002**, *12*, 329-332.

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82. Williams, S. J.; Senaratne, R. H.; Mougous, J. D.; Riley, L. W.; Bertozzi, C. R. 5'-Adenosinephosphosulfate Lies at a Metabolic Branchpoint in Mycobacteria. *J. Biol. Chem*. **2002**, *277*, 32606-32615.

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