

**CURRICULUM VITAE**  
*Michael S. VanNieuwenhze, PhD*  
Standiford H. Cox Professor of Chemistry

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**EDUCATION**    *Postdoctoral Research Associate, Department of Chemistry, The Scripps Research Institute, 1992-1994.* Research Advisor: Professor K. Barry Sharpless (Nobel Laureate 2001); Area of Research: The Osmium-Catalyzed Asymmetric Dihydroxylation Reaction.

*Ph.D. (Organic Chemistry), Department of Chemistry, Indiana University, 1988-1992.* Thesis Advisor: Professor William R. Roush; Dissertation Title: "Studies in Acyclic Stereoselection: I. The Exo-Anomeric Effect as a Novel Method for Asymmetric Induction. II. A Fragment Assembly Aldol Approach Toward the Synthesis of the Polypropionate Subunit of Rutamycin B. III. A Stereochemically General Synthesis of 2-Deoxyhexoses via the Asymmetric Allylboration of 2, 3-Epoxyaldehydes"

*M.S. (Organic Chemistry), Department of Chemistry, Yale University, 1986-1988.* Research Advisor: Professor Samuel J. Danishefsky; Area of Research: Degradation studies on the ionophore antibiotic zincophorin; Lewis acid-catalyzed diene-aldehyde condensation reactions.

*B.A. (Chemistry), Department of Chemistry, Kalamazoo College, 1980-1984.* Research Advisor: Professor Thomas J. Smith; Dissertation Title: "Synthesis and Characterization of Various Multidentate and Macrocyclic Complexes of Copper (II) and Oxovanadium (IV)"

**PROFESSIONAL EXPERIENCE**

2019-              Director of Chemistry, Door Pharmaceuticals, LLC

2018-              Standiford H. Cox Professor of Chemistry, Department of Chemistry, Indiana University

2016-              Professor, Department of Chemistry, Indiana University

2015                Visiting Fellow, Institute for Advanced Study, University of Warwick (UK)

2015                Visiting Fellow, Centre for Bacterial Cell Biology, Newcastle University (UK)

2013                Associate Professor *with tenure*, Department of Chemistry, Indiana University, Bloomington, IN

2013-              Adjunct Professor of Molecular and Cellular Biochemistry

2013-              Affiliate, Department of Biology, Microbiology Group

2007-2013	Associate Professor, Department of Chemistry, Indiana University, Bloomington, IN
2004-2007	Assistant Professor IV, Department of Chemistry and Biochemistry, University of California, San Diego, La Jolla, CA
2003-2013	Core Director (Core F (b): Novel Lipid Synthesis and Synthetic Design), Lipid MAPS Consortium ( <a href="http://www.lipidmaps.org">www.lipidmaps.org</a> )
2002-2004	Assistant Professor III, Department of Chemistry and Biochemistry, University of California, San Diego, La Jolla, CA
2000-2002	Research Scientist, Discovery Chemistry Research, Lilly Research Laboratories, A Division of Eli Lilly and Company, Indianapolis, IN.
1998	Lecturer, Department of Chemistry, Indiana University/Purdue University at Indianapolis, Indianapolis, IN.
1994-2000	Senior Organic Chemist, Discovery Chemistry Research, Lilly Research Laboratories, A Division of Eli Lilly and Company, Indianapolis, IN
1984-1986	Research Assistant, Parke-Davis Pharmaceutical Division of Warner-Lambert, Inc., Ann Arbor, MI.

## HONORS AND AWARDS

- Visiting Fellow, Institute for Advanced Study, University of Warwick, UK (2015)
- University Research Committee Visiting Professor, Centre for Bacterial Cell Biology, University of Newcastle, UK (2015)
- Indiana University Outstanding Faculty Collaborative Research Award (2014)
- Eli Lilly and Company New Faculty Award (2004)
- Hellman Foundation Fellow, University of California, San Diego (2003-2004)
- Lilly Research Laboratories, Presidents Recognition Award (1999)
- National Institutes of Health Postdoctoral Fellowship (1992-1994)
- Amoco Foundation Fellowship, Indiana University (1991-1992)
- Heyl Foundation Fellowship, Yale University (1986-1988)
- Honors Scholarship, Kalamazoo College (1980-1984)

## REFEREED PUBLICATIONS

87. Sogues, A.; Martinez, M.; Gaday, Q.; Ben-Assaya, M.; Graña, M.; Voegelé, A.; VanNieuwenhze, M.; England, P.; Haouz, A.; Chenal, A.; Trépout, S.; Duran, R.; Wehenkel, A. M.; Alzari, P., "Essential dynamic interdependence of FtsZ and SepF for Z-ring and septum formation in *Corynebacterium glutamicum*," manuscript submitted to *Nature Microbiology*.
86. Kuru, E.; Radkov, A.; Meng, X.; Egan, A. E.; Alvarez, L.; Dowson, A. D.; Booher, G.; Breukink, E.; Roper, D.; Cava, F.; Vollmer, W.; Brun, Y. V.; VanNieuwenhze, M. S., "Mechanisms of incorporation for D-amino acid probes that target peptidoglycan biosynthesis," manuscript submitted to *ACS Chemical Biology*.

85. Pazos, K.; Pazos, M.; VanNieuwenhze, M. S.; Vollmer W., "Optimized Protocol for the Incorporation of FDAA (HADA Labeling) for in situ Labeling of Peptidoglycan," *Bio. Protoc.* **2019**, 9(15) August 5, 2019. DOI: 10.21769/BioProtoc.3316.
84. Hsu, Y.-P.; Booher, G.; Egan, A.; Vollmer, W.; VanNieuwenhze, M. S., "D-amino acid derivatives as in situ probes for visualizing peptidoglycan biosynthesis," *Acc. Chem. Res.* **2019**, DOI: 10.1021/acs.accounts.9b00311.
83. Culp, E. J.; Waglechner, N.; Wang, W.; Fiebig-Comyn, A. A.; Hsu, Y.-P.; Koteva, K.; Sychantha, D.; Coombes, B. K.; VanNieuwenhze, M. S.; Brun, Y.; Wright, G. D., "A 'genes-first' phylogeny-based strategy discovers antibiotics with novel modes of action," manuscript *under revision* for *Nature*.
82. Cross, T.; Ransegnola, B.; Shin, J.-H.; Weaver, A.; Fauntleroy, K.; VanNieuwenhze, M.; Westblade, L. F.; Dörr, T. "Spheroplast-mediated carbapenem tolerance in Gram-negative pathogens," *Antimicrob. Agents Chemother.* **2019**, July 8, 2019. DOI: 10.1128/AAC.00756-19.
81. Taylor, J. A.; Bratton, B. P.; Sichel, S. R.; Jacobs, H. M.; Blair, K. M.; DeMeester, K. E.; Kuru, E.; Gray, J.; Biboy, J.; VanNieuwenhze, M. S.; Vollmer, W.; Grimes, C. L.; Shaevitz, J. W.; Salama, N. R., "Distinct cytoskeletal proteins define zones of enhanced cell wall synthesis in *Helicobacter pylori*," manuscript submitted to *eLife*.
80. Reichmann, N. T.; Tavares, A. C.; Saraiva, B. M.; Jouselin, A.; Reed, P.; Pereira, A. R.; Monteiro, J. M.; Sobral, R. G.; VanNieuwenhze, M. S.; Fernandes, F.; Pinho, M. G., "SEDS-bBPB pairs direct lateral and septal peptidoglycan in *Staphylococcus aureus*," *Nat. Microbiol.* **2019**, 4, 1368-1377. DOI: 10.1038/s41564-019-0437-2.
79. Li, Z.; Gentry, Z.; Murphy, B.; VanNieuwenhze, M. S., "Expedient and scalable synthesis of orthogonally-protected  $\beta$ -methylanthionines by indium(III)-mediated ring-opening of aziridines," *Org. Lett.* **2019**, 21, 2200-2203. DOI: 10.1021/acs.orglett.9b00125.
78. Hsu, Y.-P.; Hall, E.; Booher, G.; Murphy, B.; Radkov, A. D.; Yablonowski, J.; Mulcahey, C.; Alvarez, L.; Cava, F.; Brun, Y. V.; Kuru, E.; VanNieuwenhze, M. S., "Fluorogenic D-amino acids enable real-time monitoring of peptidoglycan biosynthesis and high-throughput transpeptidation assays," *Nat. Chem.* **2019**, 11, 335-341. DOI: <https://doi.org/10.1038/s41557-019-0127-x>. PMID: 30804500. PMCID: PMC6444347.
77. Peng, R.; VanNieuwenhze, M. S., "Studies toward the Total Synthesis of Nogalamycin: Construction of the Complete ABCDEF-ring System via a Convergent Hauser Annulation," *J. Org. Chem.* **2019**, 84, 760-768. DOI: 10.1021/acs.joc.8b02602.
76. Peng, R.; VanNieuwenhze, M. S., "Construction of the DEF-Benzoxocin Ring System of Nogalamycin and Menogaril via a Reductive Heck Cyclization," *J. Org. Chem.* **2019**, 84, 173-180. DOI: 10.1021/acs.joc.8b02575.
75. Lonergan, Z. R.; Nairn, B. L.; Hsu, Y.-P.; Wang, J.; Hesse, L. E.; Beavers, W. N.; Chazin, W. J.; VanNieuwenhze, M. S.; Giedroc, D. P.; Skaar, E. P., "An *Acinetobacter baumannii* zinc-regulated peptidase maintains cell wall integrity during immune-mediated nutrient sequestration," *Cell Reports* **2018**, 26(8), P2009-2018.E6. DOI: <https://doi.org/10.1016/j.celrep.2019.01.089>. PMID: 30784584. PMCID: PMC6441547.
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- in *Escherichia coli*,” *Front. Microbiol.* **2018**, 9, 2101. DOI: 10.3389/fmicb.2018.02101. PMCID: PMC6131605.
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71. Peters, K.; Pazos, M.; Edoó, Z.; Hugonnet, J.-E.; Martorana, A. M.; Polissi, A.; VanNieuwenhze, M. S.; Arthur, M.; Vollmer, W., “Copper inhibits peptidoglycan L,D-transpeptidase suppressing  $\beta$ -lactam resistance due to by-pass of penicillin-binding proteins,” *P. Natl. Acad. Sci, USA*, **2018**, 115 (42), 10786-10791. DOI: <https://doi.org/10.1073/pnas.180928515>. PMCID: PMC6196517.
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69. Pazos, M.; Peters, K.; Casanova, M.; Palacios, P.; VanNieuwenhze, M. S.; Breukink, E.; Vicente, M.; Vollmer, W., “Z-ring membrane anchors associate with cell wall synthases to initiate bacterial cell division,” *Nat. Commun.* **2018**, 9, 5090. DOI: <https://doi.org/10.1038/s41467-018-07559-2>.
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- Research Highlight: Thanbichler, M., “Cell Division: “Symbiotic Bacteria Turn It Upside Down,” *Curr. Biol.* **2017**, 28, R306.
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fluorescent D-amino acids for in situ labeling of bacterial cell walls,” *Chem. Sci.* **2017**, *8*, 6313-6321. DOI: 10.1039/C7SC01800B. PMCID: PMC5628581.

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  - Research Highlight: “Shameless Bacterial Predator Remodels Its Own Prey,” *Scientific American*, March 29, 2018. URL: <https://blogs.scientificamerican.com/artful-amoeba/shameless-bacterial-predator-remodels-its-own-prey/>
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  - Research Highlight: “Treadmilling runs bacterial division,” *Nat. Rev. Microbiol.* **2017**, *15*, 193. DOI: 10.1038/nrmicro.2017.24.
  - Indiana University News Release: “IU researchers help add greater precision to fight against antibiotic-resistant bacteria,” February 16, 2017. URL: <http://archive.news.indiana.edu/releases/iu/2017/02/superbug-cellular-division.shtml>
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55. O’Connor, R. D.; Singh, M.; Chang, J.; Kim, S. J.; VanNieuwenhze, M. S.; Schaefer, J., “Dual mode of action for plusbacin A<sub>3</sub> in *Staphylococcus aureus*,” *J. Phys. Chem. B.* **2017**, *121*, 1499-1505. DOI: 10.1021/acs.jpcc.6b11039. PMCID: PMC 4856321.
54. Atwal, S.; Giengkam, S.; VanNieuwenhze, M.; Salje, J., “Live imaging of the genetically intractable obligate intracellular bacteria *Orientia tsutsugamushi* using a panel of fluorescent dyes,” *J. Microbiol. Meth.* **2016**, *130*, 169-176. PMCID: PMC5073074.
53. Huggonet, J.-E.; Mengin-Lecreulx, D.; Monton, A.; den Blaauwen, T.; Carbonelle, E.; Vexkerlé, C.; Brun, Y. V.; VanNieuwenhze, M.; Bouchier, C.; Tu, K.; Rice, L. B.; Arthur, M., “Factors essential for L,D-transpeptidase-mediated peptidoglycan cross-linking and  $\beta$ -lactam resistance in *Escherichia coli*,” *eLife* **2016**; *5*:319469. DOI: 10.7554/eLife.19469. PMCID: PMC5089857.

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- Work featured on cover: *J. Bacteriol.* **2015**, 197, 3463-3471.
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44. Kuru, E.; Tekkam, S.; Hall, E.; Brun, Y. V.; VanNieuwenhze, M. S., "Synthesis of fluorescent D-amino acids and their use for probing peptidoglycan synthesis and bacterial growth *in situ*," *Nat. Protoc.* **2015**, 10, 33-52. DOI: 10.1038/nprot.2014.197. PMID: PMC 4300143.
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- MicroCommentary: Cadby, I. T.; Lovering, A. L., “Molecular surveillance of the subtle septum: discovering a new mode of peptidoglycan synthesis in streptococci,” *Mol. Microbiol.* **2014**, *94* (1), 1-4. DOI: 10.1111/mmi.12756.
  - Work featured on cover: *Mol. Microbiol.* **2014**, *94* (1); URL: <http://onlinelibrary.wiley.com/store/10.1111/mmi.12795/asset/mmi12795.pdf?v=1&t=i0tsajk7&s=b4a6b9e49c66fe6455260ce6ae9da01b776b1f0a>
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- Research Highlight: Mohammadi, T.; Breukink, E., “The Chlamydial Anomaly Clarified?” *ChemBioChem* **2014**, *15*, 1391-1392.
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2010	<i>Ad-hoc</i> Member, NIH Study Section, Synthetic and Biological Chemistry (Section A)
2010	<i>Ad-hoc</i> Member, NIH Study Section, Synthetic and Biological Chemistry (Section B)
2009	<i>Ad hoc</i> Member, NIH Drug Discovery and Small Business Review Panel (SBIR/STTR)
2008-2009	<i>Ad hoc</i> Member, Review Panel, Preclinical Product Development Team, Indiana CTISI
2006-2008	Member, Division of Medicinal Chemistry (ACS), Long-Term Planning Committee
2006	Grant Reviewer, Research Corporation, Cottrell College Science Award Program
2005	Grant Reviewer, Petroleum Research Fund, American Chemical Society
2005	<i>Ad Hoc</i> Member, NIH Study Section, BCMB
2005	NSF SBIR Review Panel
2005	NSF CHE Review Panel
2005	<i>Ad-hoc</i> Member, NIH Study Section, Synthetic and Biological Chemistry (Section A)
2004	<i>Ad-hoc</i> Member, NIH Study Section, Bioorganic and Natural Products Chemistry
2003-2006	Educational Policy and Academic Oversight Committee, UCSD School of Pharmacy
2002	<i>Ad-hoc</i> Member, NIH Study Section, Bioorganic and Natural Products Chemistry
1997-1999	Chair, Organic Chemistry Academic Contacts Committee, Eli Lilly and Company

## CONSULTING

2015-	Williams and Connolly, LLP
2008	Rigel Pharmaceuticals, Inc., South San Francisco, CA
2003-2007	ChemBridge Research Laboratories, Rancho Bernardo, CA
2002-2004	Embiosis (formerly Microgenomics), Carlsbad, CA

## MEMBERSHIPS AND PROFESSIONAL SOCIETIES

- Member, American Chemical Society
- Senior Distinguished Advisor to the Board, Medicinal and Bioorganic Chemistry Foundation
- Member, American Association for the Advancement of Science
- Member, American Society for Microbiology

## **ADMINISTRATIVE SERVICE**

- Steering Committee Member, Indiana University Precision Health Initiative (March 1, 2019-)
- Indiana University Precision Health Initiative, Center for Chemical Biology and Biotherapeutics (C2B2, March 1, 2019-)
- Member, Molecular Therapeutics Program, Indiana Clinical and Translational Sciences Institute (2013-present)

## **OTHER PROFESSIONAL SERVICE**

- Organizer, 14<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 27-31, 2019, Steamboat Springs, CO.
- Organizer, 13<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 22-26, 2017, Steamboat Springs, CO.
- Organizer, 12<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 25-29, 2015, Steamboat Springs, CO.
- Organizer, 11<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 20-25, 2013, Steamboat Springs, CO.
- Chair, 2012 Gordon Research Conference on Natural Products
- Alternate Academic Councilor, ACS Division of Medicinal Chemistry (MEDI) 2012-2014
- Vice Chair, 2011 Gordon Research Conference on Natural Products
- Organizer, "Young Investigators Symposium," Division of Organic Chemistry, Central Regional Meeting of the American Chemical Society, June 8-10, 2011, Indianapolis, IN
- Organizer, 10<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 23-28, 2011, Steamboat Springs, CO.
- Organizer, 9<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 25-29, 2009, Steamboat Springs, CO
- Organizer, 7<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, February 26-March 2, 2006, Clearwater Beach, FL
- Organizer, 6<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, January 23-29, 2005, Steamboat Springs, CO.

## **INVITED PRESENTATIONS AND LECTURESHIPS**

- Plenary Lecture, 2019 Great Wall Symposium "The Dynamics of Peptidoglycan Structure and Function: New Insights into the Great Wall", Pasteur Institute, Paris, France; September 25, 2019.
- Vanderbilt Institute of Chemical Biology/Vanderbilt Institute for Infection, Immunology, and Inflammation, Vanderbilt University, Nashville, TN; January 15, 2019.
- Department of Chemistry, The Scripps Research Institute, La Jolla, CA; November 16, 2018.
- Professor H. Alex Brown Memorial Symposium, Vanderbilt Institute of Chemical Biology, Vanderbilt University, Nashville, TN; November 5, 2018.
- Plenary Lecture, The Gordon Research Conference on Bacterial Cell Surfaces, Mt. Snow, VT; June 25, 2018.
- Department of Chemistry, Michigan State University, East Lansing, MI; April 25, 2018.
- Plenary Speaker, Aldrich Excellence in Chemistry Symposium, University of Texas Southwestern Medical Center, Dallas, TX; March 29, 2018.
- Department of Chemistry, Wayne State University, Detroit, MI; February 7, 2018.

- 8th Annual August M. Watanabe Symposium on Chemical Biotechnology, Indiana University, Bloomington, IN; September 30, 2017.
- Department of Chemistry, The University of Utah, Salt Lake City, UT; September 21, 2017.
- Department of Chemistry, Ball State University, Muncie, IN; April 27, 2017.
- American Chemical Society National Meeting, Division of Biological Chemistry, “Chemical Probes for Bacterial Imaging,” San Francisco, CA; April 5, 2017.
- Department of Chemistry, University of Utah, Salt Lake City, UT; November 21, 2016.
- Department of Chemistry and Biochemistry, University of Oregon, Eugene, OR; November 11, 2016.
- Department of Chemistry, Oregon State University, Corvallis, OR; November 10, 2016.
- Discovery Chemistry Research and Technologies, Eli Lilly and Company, Indianapolis, IN; October 18, 2016.
- Philadelphia Organic Chemists Club, University of Pennsylvania, Philadelphia, PA; September 22, 2016.
- Plenary Speaker, 2015 Great Wall Symposium “The Dynamics of Peptidoglycan Structure and Function: New Insights into the Great Wall”, Florence, Italy; September 21, 2015.
- Indiana University, Department of Chemistry; September 10, 2015.
- The Ohio State University, Department of Chemistry/Medicinal Chemistry and Pharmacognosy; September 8, 2015.
- University of Warwick, School of Life Sciences, Coventry, UK; July 1, 2015.
- The University of Sheffield, Department of Molecular Biology and Biotechnology, Sheffield, UK; June 10, 2015.
- Purdue University, Department of Medicinal Chemistry and Molecular Pharmacology, West Lafayette, IN; June 2, 2015.
- Newcastle University, Centre for Bacterial Cell Biology, Newcastle, UK; May 1, 2015.
- BACELL 2015, European Bacillus Meeting, Amsterdam, Netherlands; April 15, 2015.
- Newcastle University, School of Chemistry, Newcastle, UK; April 10, 2015.
- Trinity College/Dublin, School of Genetics and Microbiology, Dublin, Ireland; March 26, 2015.
- Newcastle University, Institute of Cellular and Molecular Biology, Newcastle, UK; March 20, 2015.
- Yale University, Chemical Biology Institute Lecture Series, New Haven, CT; February 3, 2015.
- University of Michigan, Department of Medicinal Chemistry, Ann Arbor, MI; January 2015.
- Winter Conference on Medicinal and Bioorganic Chemistry, Steamboat Springs, CO; January 26, 2015.
- Indiana University, Outstanding Faculty Collaborative Research Award Symposium; December 12, 2014.
- The Scripps Research Institute, Department of Chemistry, Jupiter, FL; December 4, 2014.
- University of Warwick, Departments of Chemistry/Chemical Biology, Coventry, UK; May 27, 2014.
- Centre for Bacterial Cell Biology, University of Newcastle, Newcastle, UK; May 22, 2014.
- Imperial College/London, Department of Chemistry, London, UK; May 20, 2014.
- MRC Laboratory of Molecular Biology, Cambridge, UK; May 19, 2014.
- Southern Research Institute, Birmingham, AL; September 9, 2013.
- Baylor University, Department of Chemistry, Waco, TX; April 26, 2013.
- Department of Chemistry/Vanderbilt Institute of Chemical Biology, Nashville, TN; February 20, 2013.
- University of Louisville, Department of Chemistry, Louisville, KY; October 24, 2012.
- The Scripps Research Institute, Department of Chemistry, Jupiter, FL; May 5, 2012.
- University of Pittsburgh, Department of Chemistry, Pittsburgh, PA; April 26, 2012.
- University of California at Los Angeles, Department of Chemistry, Los Angeles, CA; December 15, 2011.
- University of California at Irvine, Department of Chemistry, Irvine, CA; December 14, 2011.
- University of California at San Diego, Department of Chemistry, La Jolla, CA; December 12, 2011.



- 2<sup>nd</sup> Annual August M. Watanabe Symposium on Chemical Biotechnology, Indiana University, Bloomington, IN; October 15, 2011.
- St. Jude Children's Research Hospital, Memphis; TN, October 6, 2011.
- University of Illinois, Department of Chemistry; Urbana/Champaign, IL, April 21, 2011
- Indiana Medicinal Chemistry Symposium, IUPUI; October 2, 2010.
- Indiana University/Purdue University at Indianapolis; Department of Chemistry, April 28, 2010.
- The Scripps Research Institute, Department of Chemistry; December 10, 2009.
- University of Colorado, Department of Chemistry; October 19, 2009.
- 49<sup>th</sup> Interscience Conference on Antimicrobial Agents and Chemotherapy, San Francisco, CA; September 12, 2009.
- Gordon Research Conference on Natural Products, Tilton, NH; July 30, 2009.
- 21<sup>st</sup> American Peptide Symposium, Bloomington, IN; June 11, 2009.
- Creighton University, Department of Chemistry; February 12, 2009.
- Rigel Pharmaceuticals, Inc., San Francisco, CA, Cooper Symposium; October 23, 2008
- "Novel Antibiotics, Old and New Targets," The University of Notre Dame, Notre Dame, IN; June 28-29, 2008.
- Indiana University, Microbiology Working Group, Department of Biology; March 18, 2008.
- University of Louisville, Department of Chemistry; February 8, 2008.
- Rigel Pharmaceuticals, Inc., San Francisco, CA, Division of Medicinal Chemistry; January 11, 2008.
- University of Alberta, Department of Chemistry; November 19, 2007.
- Michigan Technological University, Department of Chemistry; September 27, 2007.
- Eli Lilly and Company, Lilly Research Laboratories; August 21, 2007.
- Indiana University, Department of Chemistry; May 10, 2007.
- University of Kansas, Department of Medicinal Chemistry, School of Pharmacy; February 15, 2007.
- 10<sup>th</sup> Annual San Diego Glycobiology Symposium, San Diego; January 19, 2007.
- University of North Carolina, Department of Medicinal Chemistry, School of Pharmacy; March 2, 2006.
- 7<sup>th</sup> Winter Conference on Medicinal and Bioorganic Chemistry, Clearwater Beach, FL; March 1, 2006.
- Northwestern University, Department of Chemistry; January 9, 2006.
- The Scripps Research Institute, Department of Medicinal Chemistry, Jupiter, FL; September 15, 2005.
- 46<sup>th</sup> Annual Meeting of the American Society of Pharmacognosy, Corvallis, OR; July 23-27, 2005.
- 7<sup>th</sup> Annual San Diego Combichem/Medchem Symposium, San Diego, CA, July 16, 2004.
- University of Regensburg, Departments of Chemistry and Pharmacy; July 11, 2003.
- University of Regensburg, Department of Chemistry (INNOVATEC Lectures); July 7, 2003.
- University of Regensburg, Department of Chemistry; July 2, 2003.
- University of Regensburg, Department of Chemistry (INNOVATEC Lectures); June 30, 2003.
- Triad Therapeutics, Division of Medicinal Chemistry, La Jolla, CA; August 28, 2002.
- University of California, Los Angeles, Department of Chemistry; January 17, 2002.
- Northwestern University, Department of Chemistry; December 5, 2001.
- State University of New York at Buffalo, Department of Chemistry; November 2001.
- University of Oregon, Department of Chemistry; November 2001.
- University of Alabama, Department of Chemistry; November 2001.
- University of Kansas, Department of Medicinal Chemistry; November 2001.
- University of California at San Diego, Department of Chemistry and Biochemistry; October 29, 2001.
- Yale University, Department of Chemistry; October 17, 2001.
- Wayne State University, Department of Chemistry; September 5, 2001.
- 221<sup>st</sup> National Meeting of the American Chemical Society, San Diego, CA, April 2001.

- 4<sup>th</sup> Winter Conference on Bioorganic and Medicinal Chemistry, Steamboat Springs, CO, February 2001.
- The Scripps Research Institute, Department of Chemistry, La Jolla, CA; Jan. 19, 2001.
- Pacificchem 2000, Honolulu, HI, Dec. 15, 2000.
- Indiana University, Department of Chemistry; Nov. 20, 2000.
- University of Notre Dame, Department of Chemistry; Nov. 15, 2000.
- University of California at San Diego, Department of Chemistry and Biochemistry; Nov. 8, 2000.
- Montana State University, Department of Chemistry; Sept. 29, 2000.
- Lilly Research Laboratories, Chemistry Seminar Series, Indianapolis, IN, August 22, 2000.
- Gordon Research Conference on Stereochemistry, Newport, RI, June 12, 2000.
- Hamburg Laboratories of Eli Lilly and Company, Hamburg Germany, Feb. 23, 2000.
- Tippecanoe Laboratories of Eli Lilly and Company, Lafayette, IN, Nov. 5, 1999.
- Pacific Conference on Chemistry and Spectroscopy, Pasadena, CA, October 1993.

## RESEARCH SUPPORT

### Active Grant Support

#### **R01 GM113172 (MPI Application)**

**National Institutes of Health (NIGMS)**

Role: Contact PI

**2/5/2015– 11/30/2018**

**\$2,288,064/\$3,367,292 total**

**(\$560,874, \$822,655 total)**

NCE until 11/30/2019

“Dynamics of Bacterial Peptidoglycan Biosynthesis”

The long-term goal of this application is to elucidate the mechanism(s) of peptidoglycan (PG) synthesis dynamics. This will be achieved through the development of improved fluorescent D-amino acids (FDAAs) with improved photophysical properties and to use nanochannel and microfluidic devices to determine the dynamics of PG synthesis in ovoid and rod-shaped bacteria. At the conclusion of these studies, we will have synthesized a new set of fluorescent probes that will greatly facilitate the study of PG synthesis at high spatiotemporal resolution, we will have developed microfluidic devices with precise liquid handling that will enhance our ability to use the FDAA probes to study PG synthesis with cutting-edge microscopy in time-lapse and real time studies, and we will identify new genes that control the dynamics of PG synthesis.

#### **1 R01 GM111537**

**National Institutes of Health (NIGMS)**

Role: PI

**9/1/2014 – 8/31/2018**

**(\$910,748/\$1,388,404 total)**

NCE until 8/31/2019

“Novel Inhibitors of Peptidoglycan Synthesis Targeting Gram-positive Pathogens”

The focus of this grant application is to leverage our developing expertise in depsipeptide antibiotics that inhibit bacterial cell wall biosynthesis, in order to gain insight into how these agents manifest their biological activity, and how the cell wall biosynthetic machinery responds to antibiotic challenge(s).

#### **Indiana University Grand Challenges**

**Indiana University**

Role: Co-Investigator

**12/1/2018-11/30/2023**

**(\$795,246 total)**

“Developing a Better Naloxone”

This application was submitted in response to the Indiana University Grand Challenges initiative entitled, “Responding to the Addictions Crisis” and will seek to determine whether novel derivatives of cannabidiol and salvinorin will act as negative allosteric modulators of the mu opioid receptor for the treatment of opioid overdose.

**Pending Grant Applications**

***Submitted***

**National Institutes of Health**  
Role: PI

**5/1/2020 – 4/30/2025**  
**(\$1,712,520/2,944,600 total)**

“Chemical Biology Studies of the Dynamics and Inhibition of Peptidoglycan Biosynthesis”

This R35 (MIRA) application combines the activities described under GM111537 and GM113172. The longer-term goals of this application are to: 1) Continue study of the post-septational phase of bacterial cell division in *Bacillus subtilis*, 2) develop improved probes that enable real-time imaging of peptidoglycan biosynthesis and dynamics without washing, 3) continued detailed study of the mechanism of action of cyclic depsipeptides such as plusbacin A<sub>3</sub>, lysobactin, and empedopeptin 4) elucidation of the lipid recycling pathway that is central to peptidoglycan biosynthesis and evaluating its potential to provide novel antibacterial targets.

***Submitted***

**National Institutes of Health**  
Role: Co-Investigator

**4/1/2020-3/31/2025**  
**(\$362,330/574,188 total)**

“Antiviral Modulation of Viral Structural Proteins”

This R01 application seeks to develop an understanding of the mechanism of a new class of HBV-specific antivirals, known as Core protein Allosteric Modulators (CpAMs), that target the viral core protein known to have roles in virtually every stage of the viral life cycle from capsid assembly to genome release. The diverse role(s) of the core protein present multiple opportunities for interrupting the HBV life cycle, destabilizing the infection, and creating the potential for identification of cures for chronic HBV.

**Completed Research Support**

**R01 AI067417-07 (A. Zlotnick, PI)**  
**National Institutes of Health (NIAID)**  
Role: Co-Investigator

**7/1/2011-6/30/2016**

“Molecular Modulation of Hepatitis B Virus Assembly”

The major goal of this grant is to study compounds that interfere with normal HBV capsid assembly. In collaboration with the Zlotnick laboratory, we are preparing compounds and fluorescent probes that are being used to accelerate capsid assembly and enable more detailed study of the kinetics of capsid assembly.

**Faculty Research Support Program (FRSP)**  
**Indiana University**  
Role: PI

**12/1/13-11/30/14**

“Elucidation of the Pathways for Incorporation of Fluorescently Modified D-Amino Acids into Sites of Active Peptidoglycan Synthesis”

The major goal of this research is to advance our understanding of the mechanism(s) by which fluorescently modified D-amino acids are incorporated into peptidoglycan.

**1 U54 GM069338-09**

**8/1/2008-7/31/2013**

**NIH/NIGMS**

Role: Core Director

“Lipid Metabolomics and Proteomics Strategy”

This consortium developed a system capable of characterizing changes in lipid metabolites of murine macrophage cell lines. My laboratory provided chemistry support to assist lipid identification and characterization efforts of the other core groups within the consortium.

**1 RO1 HL086559 (J. Witztum, PI)**

**3/1/2007-2/29/2012**

**NIH/NIGMS**

Role: Collaborator

“Development of a Vaccine Approach to Inhibit Atherosclerosis”

The major goal of my laboratory was the synthesis and characterization of synthetic haptens for use in the generation of antibodies that may be components for the development of a vaccine approach for treatment of atherosclerosis.

**Johnson and Johnson Research Grant**

**8/2009-8/2010**

Role: PI

“Mechanism of Action and SAR (Structure-Activity Relationships) of New Cell Wall Antibiotics”  
(with Malcolm Winkler, Department of Biology, Indiana University)

The focus of this project was the synthesis and evaluation of depsipeptide antibiotics that inhibited peptidoglycan biosynthesis.

**1 R01 AI059327**

**12/01/2004 – 11/31/2009**

**National Institutes of Health (NIGMS)**

Role: PI

“Synthesis and Mechanistic Studies of Peptide Antibiotics”

The major goals of this project were the synthesis and mechanistic study of peptide antibiotics that function via inhibition of late-stage enzymes involved in peptidoglycan biosynthesis.

**University of California**

**7/01/2003 – 6/30/2004**

**Cancer Research Coordinating Committee (CRCC)**

Role: PI

“Construction of the (C) DEF-Benzoxocin Ring System of Nogalamycin via a Reductive Heck Cyclization”

The major goal of this project was the development of a synthetic route to access a key subunit of the anthracycline core present in members of the nogalamycin family of antitumor antibiotics.

**Hellman Foundation Fellowship**

**7/01/2003 – 6/30/2004**

**University of California**

Role: PI

“Peptidoglycan Biosynthesis: Inhibition and Chemical Mimicry”

The major goal of this project was to initiate efforts toward the chemical synthesis of polymerized and cross-linked glycan strands.

**1 R21 AI059327-01**

**4/1/2004 – 11/30/2004**

**NIH/NIAID**

Role: PI

“Synthesis and Mechanistic Studies of Peptide Antibiotics”

The major goals of this project are the synthesis and mechanistic study of peptide antibiotics that function via inhibition of late-stage enzymes involved in peptidoglycan biosynthesis. Converted to R 01 AI059327 effective 12/01/04.

## **RESEARCH GROUP COMPOSITION/HISTORY**

**Current Graduate Students** Ziran Li (2012-), Garrett Booher (2014-), Brennan Murphy (2014-), Wyatt Paulishak (2016-), Michael MacKnight (2016-), Lily Klapper (2017-), Jacob Marler (2017-), Jessie Gudorf (2018-), Zach Taylor (2018-)

**Current Undergraduate Students** Caitlin Mulcahey (IFLE/STARS, 2016-); William Jackson (2016-); Jonathan Dietrich (2017-); Malinda Jack (2019-); Brianna Baughman (2019-); Wynne Milhouse (2019-)

**Former Graduate Students** Cheryl Billstrom (MS, 2004, UCSD); Jeff Gaulin (MS, 2004, UCSD); Luis Rivera-Rios (MS, 2004, UCSD); Kimberly Schwarz (MS, 2004, UCSD); Ryan Lamer (MS, 2006, UCSD); Rebecca Harbach (MS, 2006, UCSD); Emily Rolfes (MS, 2007, UCSD); Audrey Kelleman; (PhD, 2007, UCSD); Aikomari Guzman-Martinez (PhD 2007, UCSD); Aaron Wohlrab (PhD, 2007, UCSD); Pablo Garcia-Reynaga (PhD, 2010, IU); Kevin Olivier (PhD, 2010, IU); John Tipping (MS, 2011, IU); Seth Carmody (PhD, 2011, IU); Dan Meyers (MAT, 2011, IU), Angela Carrillo (PhD, 2012, IU), Randall Binder (PhD, 2013, IU), Ruogu Peng (PhD, 2013, IU); Edward Hall (PhD, 2014, IU); Srinivas Tekkam (PhD, 2014, IU); Erkin Kuru (PhD, 2015, IU); Jonathan Rittichier (PhD 2016, IU); Jacob Yablonowski (MS, 2017, IU), Yen-Pang Hsu (PhD, 2018, IU).

**Former Postdoctoral Associates** Radha Narayan (2004-06); Jesse More (2004-05); Michael Kruppa (2005-06); Bingfeng Shi (2006-07); Chunping Xu (2007); Chun-li Cao (2008-10) Alvin Kalinda (2009-11); Erick Pasciak (2015-16); Ramakrishna De (2015-2017), Atanas Radkov (2015-2017), Yen-Pang Hsu (2018-19).

**Former Undergraduate Students** Felix Lin (2002); Doan T. Bui (2002-03); Mingyu Ngai (2003); Linda Le (2003); Sanaz Farhadian (2003); Karla Arias (2003-04); Jeff Bird (2004); Eliana Bukofzer (2004); Michelle Tetelman (2004-05); Tristan Beaudette (2004-05); Joseph Kubicki (2004); Christine Ta (2005); Andrew Weeks (2005); Neil Hadaegh (2005-06); Phison Pham (2006); Minas Melidonian (2006); Tyger Saltman (2006-07); Peter Yu (2006); James Jung (2006); Amit Pithadia (2008-10), Stephen Mendenhall (2008-10); Sophia Kang (STARS, 2009-11); Julie Neel (2009-11); George Venious (2009-11); Greg Lasker (2010-11); Parth Patel (2010-11); Matthew Johnson (2010-2011); Sara Rasamimari (2011-12); Jordan Jewett (STARS, 2012); Jacob Shinn (2013-14); Christian McGill (2013-14); Kevin Lettelier (STARS, 2014); Zachary Wakefield (2014-2016); Robert Lennex (2016), Alex West (2013-2017), Lucas Howell (2016-2018), Praise Kim (2016-2018), Alex Mabry (2016-2018), Zach Gentry (2016-2019), Bella Lee (2017), Emily Langella (2017), Adam Mitrevski (2017-19), Annika Tharp (2018), Jisu Kim (2018), Glara Baek (2018), Jun Young (2018).

## CONTRIBUTIONS TO THE DEPARTMENT AND THE UNIVERSITY

**PhD Committee Memberships (Indiana University):** Martin Walsh, PhD, 2009; Cullen Klein, PhD, 2009; Micheal Fultz, PhD, 2009; James Patterson, PhD, 2011; Elizabeth Opsitnick, PhD, 2011; Ramakrishna De, PhD, 2012; Wenjun Liu, PhD, 2012; Joseph Pinchman, PhD, 2012; Benjamin Wicker, PhD, 2012; Bruce Atwater, PhD, 2013; Johnathon Hutt, PhD, 2013; Pucheng Ke, PhD, 2013; Fese Mokube, PhD, 2013; Prolay Monday, PhD, 2013; Partha Nag, PhD, 2013; Paul Gladen, PhD, 2014; Kevin McDonald, PhD, 2014; Akshay Shah, PhD, 2014; Latisha Jefferies, PhD, 2015; Fangzhou Wu, PhD, 2016; Michael Conner, PhD, 2017; Yao Zhu, PhD, 2017; Alison Vickman, PhD, 2018; Tianyuan Peng, PhD, 2018; Keevan Marion, PhD, 2019; Seth Bawel, PhD, 2019; Paul Marcyk, PhD, 2019, Daisy Vargas, PhD, 2019).

### Courses Taught

<b>2002-2003</b>	Chemistry 254/154, Mechanisms of Organic Reactions; SPPS 221, Advanced Organic Chemistry (School of Pharmacy)
<b>2003-2004</b>	Chemistry 254/154, Mechanisms of Organic Reactions; SPPS 221, Advanced Organic Chemistry (School of Pharmacy); Chemistry 140B, Organic Chemistry
<b>2004-2005</b>	SPPS 221, Advanced Organic Chemistry (School of Pharmacy); Chemistry 140B, Organic Chemistry
<b>2005-2006</b>	SPPS 221, Advanced Organic Chemistry (School of Pharmacy); Chemistry 140B, Organic Chemistry
<b>2006-2007</b>	Chemistry 140B, Organic Chemistry
<b>2007-2008</b>	Chemistry 540, Advanced Organic Chemistry; Chemistry 648, Special Topics (Heterocycles)
<b>2008-2009</b>	Chemistry 540, Advanced Organic Chemistry
<b>2009-2010</b>	Chemistry 540, Advanced Organic Chemistry; Chemistry 644, Physical Organic Chemistry
<b>2010-2011</b>	Chemistry 540, Advanced Organic Chemistry; Chemistry 687/Biology 680, Fundamentals of Chemical Biology.
<b>2011-2012</b>	Chemistry 687/Biology 680, Fundamentals of Chemical Biology, R800 Organic Chemistry Research Seminar
<b>2012-2013</b>	Chemistry S342, Honors Organic Chemistry II; Chemistry 687/Biology 680, Fundamentals of Chemical Biology.
<b>2013-2014</b>	Chemistry S342, Honors Organic Chemistry II; Chemistry C342, Organic Chemistry II
<b>2014-2015</b>	Chemistry C540 Advanced Organic Chemistry
<b>2015-2016</b>	Chemistry C342 (Fall and Spring semesters)
<b>2016-2017</b>	Chemistry S342, Honors Organic Chemistry II; Chemistry C342 Organic Chemistry II

**2017-2018** Chemistry S342, Honors Organic Chemistry II; C681/682 Introduction to Chemical Biology

**2018-2019** C681 Introduction to Chemical Biology I; C682 Introduction to Chemical Biology II.

### **Department, Faculty and University Service/Committees**

**2002-2003** Graduate Admissions, Graduate Student Recruiting, Industrial Advisory Committee, NMR Committee

**2003-2004** Admissions, Small Molecule NMR, Industrial Advisory Committee, Space Committee, Inorganic Search Committee, Medicinal Chem. Search Comm. (SPPS), Educational Policy and Academic Oversight Committee (SPPS)

**2004-2005** Industrial Advisory Committee, Space Committee, Small Molecule NMR, Organic Chemistry Search Committee, Medicinal Chem. Search Comm. (SPPS), Chem/Biochem COO Search Committee, Educational Policy and Academic Oversight Committee (SPPS)

**2005-2006** Space Committee, Industrial Advisory Committee, Medical Sciences Training Program Admissions Committee (UCSD School of Medicine)

**2006-2007** Industrial Advisory Committee, Facilities Committee (Stockroom Subcommittee), Medical Sciences Training Program Admissions Committee (UCSD School of Medicine)

**2007-2008** Graduate Admissions, Graduate Standards and Affairs, Organic Chemistry Search Committee

**2008-2009** Facilities Committee (NMR), Graduate Standards & Affairs, Graduate Admissions, Organic Chemistry Search Committee

**2009-2010** Facilities Committee (NMR), Graduate Standards & Affairs, Graduate Admissions, Organic Chemistry Search Committee

**2010-2011** Facilities Committee (NMR), Graduate Standards & Affairs, Graduate Admissions, Organic Chemistry Faculty Search Committee, Organic Chemistry Lecturer Search Committee, Organic Chemistry Curriculum Committee

**2011-2012** Facilities Committee (NMR), Graduate Standards and Affairs, Graduate Admissions.

**2012-2013** Facilities Committee (NMR), Graduate Standards and Affairs

**2013-2014** Facilities Committee (NMR), Graduate Standards and Affairs, Diversity Affairs Committee, Hutton Honors College Faculty Fellow, Chemical Biology Faculty Recruiting (Chair)

**2014-2015** Facilities Committee (NMR), Graduate Standards and Affairs, Diversity Affairs Committee, Chemical Biology Faculty Recruiting Committee

- 2015-2016** Facilities Committee (NMR), Graduate Standards and Affairs, Diversity Affairs Committee, Awards Committee, Chemical Biology Faculty Recruiting Committee
- 2016-2017** Facilities Committee (NMR), Graduate Standards and Affairs, Awards Committee, NMR Recruiting Committee
- 2017-2018** Facilities Committee (NMR), Graduate Standards and Affairs, Colloquium Committee
- 2018-2019** Facilities Committee (NMR), Colloquium Committee, Safety Committee, College of Arts and Sciences Executive Dean Search Committee, Chair Joint Chemistry/Molecular and Cellular Biochemistry Faculty Search Committee, Steering Committee Member Indiana University Precision Health Initiative