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## EDUCATION AND TRAINING

- 1998 – 2006 *Postdoctoral Research Associate*, Princeton University. Advisor: Professor Thomas J. Silhavy
- 1998 *Doctor of Philosophy* in Molecular Microbiology and Microbial Pathogenesis, Washington University in St. Louis. Advisor: Professor Michael G. Caparon
- 1993 *Bachelor of Arts with Highest Distinction* in Microbiology and Chemistry, University of Kansas
- 1990 – 1993 *Undergraduate Research Assistant*, University of Kansas. Advisor: Professor John C. Brown

## ACADEMIC POSITIONS

- 2010 – *Assistant Professor*, Department of Microbiology, The Ohio State University
- 2006 – 2010 *Research Molecular Biologist*, Princeton University

## TEACHING EXPERIENCE

- M4130 (Microbial Genetics), Ohio State University (course director, 100%), Sp14
- M4120 (Microbial Physiology and Diversity), Ohio State University (2 lectures), Au13
- M4130 (Microbial Genetics), Ohio State University (course co-director, 70%), Sp13
- M7724 (Molecular Pathogenesis), Ohio State University (2 lectures), Sp13 and Sp14
- M8899 (Seminar in Microbiology), Ohio State University (course co-director, 50%), Au12 & Sp13
- M4120 (Microbial Physiology and Diversity), Ohio State University (3 lectures), Au12
- M6010 (Principles of Microbiology), Ohio State University (2 lectures), Au12 and Au13
- M581.01 (Microbial Genetics), Ohio State University (course director, 100%), Sp12
- M880 (Seminar in Microbiology), Ohio State University (course co-director, 50%), Au11, Wn12 & Sp12
- OSBP796 (Interdisciplinary Seminar in Advanced Biochemistry), Ohio State University (course co-director, 50%), Au11
- M724 (Molecular Pathogenesis), Ohio State University (2 lectures), Sp11
- M661 (Bacterial Physiology), Ohio State University (guest lecturer), Au10
- MCO506 (Prokaryotic and Eukaryotic Cell Biology and Genetics), Uniformed Services University of the Health Sciences, Bethesda, MD (guest lecturer), 2010

MOL380A (Modern Microbiology and Disease), Princeton University (course co-director, 33%), Sp08  
FRS166 (Microbes: Menace and Marvels), Princeton University (course director, 100%), Sp06  
MOL545 (Advanced Microbial Genetics), Princeton University (seminar course co-director, 50%), 2001  
MOL350 (Laboratory in Molecular Biology), Princeton University (lecturer), Sp01  
HHMI Undergraduate Research Summer Program, Princeton University (summer instructor), Su00  
MOL505 (Molecular Biology of Prokaryotes), Princeton University (teaching assistant), Au99  
Junior Tutorial, Princeton University (instructor), 1998  
Instructor for the Young Scientist Program in St. Louis (instructor), 1997 - 1998  
BIO100 (Introduction to Biology), Washington University in St. Louis (teaching assistant), 1994  
MCRB507 (Pathogenic Microbiology Laboratory), University of Kansas (teaching assistant), 1993  
MCRB505 (Immunology Laboratory), University of Kansas (teaching assistant), 1992

## RESEARCH SUPPORT

2012 **National Institutes of Health Grant 1RO1 GM100951.** “Biogenesis of peptidoglycan in *Escherichia coli*”. PI (07/05/2012-06/30/2016; \$1,010,773 TOTAL COST)

## REFEREED PUBLICATIONS

1. Sham, L. T., Butler, E. K., Lebar, M. D., Kahne, D., Bernhardt, T.G.\*, and **Ruiz, N.\*** (2014) MurJ is the flippase of lipid-linked precursors for peptidoglycan biogenesis. *Science* 345:220-222. PMID: 25013077. \* **Co-corresponding authors.** Highlighted in Nat Rev Microbiol (July 2014), Chemical & Engineering News (July 2014), and Faculty of 1000 (July 2014)
2. Malojčića, G., Andresa, D., Grabowicz, M., **Ruiz, N.**, Silhavy, T. J., and Kahne, D. (2014) LptE binds to and alters the physical state of LPS to catalyze its assembly at the cell surface. *Proc Natl Acad Sci U S A* 111:9467-9472. PMID: 24938785.
3. Sherman, D.J., Lazarus, M.B., Murphy, L., Liu, C., Walker, S. **Ruiz, N.\***, and Kahne, D.\* (2014) Decoupling catalytic activity from biological function of the ATPase that powers lipopolysaccharide transport. *Proc Natl Acad Sci U S A* 111:4982-4987. PMID:24639492 \* **Co-corresponding authors.**
4. Nicolaes, V., El Hajjaji, H., Davis, R., Van der Henst, C., Depuydt, M., Leverrier, P., Aersten, A., Haufroid, V., Ollagnier, S., De Bolle, X., **Ruiz, N.**, and Collet, J.F. (2013) Insights into the function of YciM, a heat-shock membrane protein required to maintain envelope integrity in *Escherichia coli*. *J Bacteriol* 196:300-309. PMID:24187084
5. Butler, E.K., Davis, R.M., Bari, V., Nicholson, P.A., and **Ruiz, N.** (2013) Structure-function analysis of MurJ reveals a solvent-exposed cavity containing residues essential for peptidoglycan biogenesis in *Escherichia coli*. *J Bacteriol* 195:4639-4649. PMID:23935042

6. Yao, Z., Davis, R.M., Kishony, R., Kahne, D., and **Ruiz, N.** (2012) Regulation of cell size in response to nutrient availability by fatty acid biosynthesis in *Escherichia coli*. *Proc Natl Acad Sci U S A* 109:E2561-E2568. PMID:22908292. Highlighted in Nature Reviews in Microbiology (October 2012), Nature Chemical Biology (October 2012), and Faculty of 1000 (September 2012).
7. Freinkman, E., Okuda, S., **Ruiz, N.**, and Kahne, D. (2012) Regulated assembly of the transenvelope protein complex required for lipopolysaccharide export. *Biochemistry* 51:4800-4806. PMID:22668317
8. Karamoko, M., Cline, S., Redding, K., **Ruiz, N.**, and Hamel, P. P. (2011) Lumen Thiol Oxidoreductase1, a disulfide bond-forming catalyst, is required for the assembly of photosystem II in *Arabidopsis*. *Plant Cell* 23:4446-4461. PMID: 22209765
9. Chimalakonda, G., **Ruiz, N.**, Chng, S.-S., Garner, R. A., Kahne, D., and Silhavy, T. J. (2011) Lipoprotein LptE is required for the assembly of LptD by the  $\beta$ -barrel assembly machine in the outer membrane of *Escherichia coli*. *Proc Natl Acad Sci U S A* 108:2492-2497. PMID: 21257909
10. **Ruiz, N.**, Chng, S.-S., Hiniker, A., Kahne, D., Silhavy, T.J. (2010) Nonconsecutive disulfide bond formation in an essential integral outer membrane protein. *Proc Natl Acad Sci U S A* 107:12245-12250. PMCID: PMC2901483.
11. Chng, S.-S., **Ruiz, N.**, Chimalakonda, G., Silhavy, T. J., and Kahne, D. (2010) Characterization of the two-protein complex in *Escherichia coli* responsible for lipopolysaccharide assembly at the outer membrane. *Proc Natl Acad Sci U S A* 107:5363-5368. PMCID: PMC2851745.
12. **Ruiz, N.**, Kahne, D., and Silhavy, T. J. (2009) Transport of lipopolysaccharide across the cell envelope: the long road of discovery. *Nature Rev Microbiol* 7: 677-683. PMCID: PMC2790178.
13. **Ruiz, N.** (2009) *Streptococcus pyogenes* YtgP (Spy\_0390) complements *Escherichia coli* strains depleted of the putative peptidoglycan flippase MurJ. *Antimicrob Agents Chemother* 53(8): 3604-3605. PMCID: PMC2715597.
14. Vertommen, D. \*, **Ruiz, N.** \*, Leverrier, P. \*, Silhavy, T.J., and Collet, J.F. (2009) Characterization of the role of the *Escherichia coli* periplasmic chaperone SurA using differential proteomics. *Proteomics* 9: 2432-2443 (\* authors contributed equally).
15. **Ruiz, N.** (2008) Bioinformatics identification of MurJ (MviN) as the peptidoglycan lipid II flippase in *Escherichia coli*. *Proc Natl Acad Sci U S A* 105: 15553-15557. PMCID: PMC2563115.
16. **Ruiz, N.**, Gronenberg, L.S., Kahne, D., and Silhavy, T.J. (2008) Identification of two inner-membrane proteins required for the transport of lipopolysaccharide to the outer membrane of *Escherichia coli*. *Proc Natl Acad Sci U S A* 105: 5537-5542. PMCID: PMC2291135.
17. Button, J.E., Silhavy, T.J, and **Ruiz, N.** (2007) A suppressor of cell death caused by the loss of  $\sigma^E$  downregulates extracytoplasmic stress responses and outer membrane vesicle production in *Escherichia coli*. *J Bacteriol* 189: 1523-1530. PMCID: PMC1855761.
18. **Ruiz, N.**, Wu, T., Kahne, D., and Silhavy, T.J. (2006) Probing the barrier function of the outer membrane with chemical conditionality. *ACS Chem Biol* 1:385-395.
19. **Ruiz, N.**, Kahne, D., and Silhavy, T. J. (2006) Advances in understanding bacterial outer membrane biogenesis. *Nature Rev Microbiol* 4: 57-66.
20. **Ruiz, N.**, Falcone, B., Kahne, D., and Silhavy, T.J. (2005) Chemical conditionality: A genetic strategy to probe organelle assembly. *Cell* 121: 307-317.

21. Wu, T., Malinverni, J., **Ruiz, N.**, Kim, S., Silhavy, T. J., and Kahne, D. (2005) Identification of a multi-component complex required for outer membrane biogenesis in *Escherichia coli*. *Cell* 121: 235-245.
22. Peterson, C. N., **Ruiz, N.**, and Silhavy, T.J. (2004) RpoS proteolysis is regulated by a mechanism that does not require the SprE (RssB) response regulator phosphorylation site. *J Bacteriol* 186: 7403-7410. PMID: PMC523208
23. **Ruiz, N.** and Silhavy, T.J. (2003) Constitutive activation of the *Escherichia coli* PHO regulon upregulates *rpoS* translation in an Hfq-dependent fashion. *J Bacteriol* 185: 5984-5992. PMID: PMC225030.
24. **Ruiz, N.**, Peterson, C. N., and Silhavy, T.J. (2001) RpoS-dependent transcriptional control of *sprE*: regulatory feedback loop. *J Bacteriol* 183: 5974-5981. PMID: PMC99676.
25. Eggert, U. S., **Ruiz, N.**, Falcone, B. V., Branstrom, A. A., Goldman, R. C., Silhavy, T. J., and Kahne, D. (2001) Genetic basis for activity differences between vancomycin and glycolipid derivatives of vancomycin. *Science* 294: 361-364.
26. Madden, J. C., **Ruiz, N.**, and Caparon, M. (2001) Cytolysin-mediated translocation (CMT): A functional equivalent of Type III secretion in Gram-positive bacteria. *Cell* 104: 143-152 and cover illustration.
27. **Ruiz, N.**, Wang, B., Pentland, A., and Caparon, M. (1998) Streptolysin O and adherence synergistically modulate proinflammatory responses of keratinocytes to group A streptococci. *Mol Microbiol* 27: 337-346.
28. Wang, B., **Ruiz, N.**, Pentland, A., and Caparon, M. (1997) Keratinocyte proinflammatory responses to adherent and nonadherent group A streptococci. *Infect Immun* 65: 2119-2126.

## NON-REFEREED PUBLICATIONS

1. **Ruiz, N.** (2013) A Bird's Eye View of the Bacterial Landscape. *Methods Mol Bio* 966:1-14.
2. **Ruiz, N.** and Silhavy, T.J. (2005) Sensing external stress: watchdogs of the *Escherichia coli* cell envelope. *Curr Opin Microbiol* 8: 122-126.

## INVITED SEMINARS

1. Department of Molecular Genetics, Ohio State University, Columbus (OH), March 6, 2014.
2. Department of Biological Sciences, University of Alberta (Canada), November 28, 2013.
3. Department of Microbiology, Universidad de Chile, Santiago de Chile (Chile), November 5, 2013.
4. Department of Microbiology, University of Illinois at Urbana-Champaign, Urbana (IL), October 17, 2013.
5. Genentech, South San Francisco (CA), July 23, 2013.
6. OSU Chemistry-Biology Interface Training Program, Ohio State University, Columbus (OH), February 19, 2013.
7. Department of Biology, Kenyon College, Gambier (OH), February 7, 2013.

8. The Child Health Research Center Speaker Series at The Research Institute at Nationwide Children's Hospital, Columbus (OH), January 31, 2013.
9. Cold Spring Harbor Laboratory Advanced Bacterial Genetics Course, Cold Spring Harbor (NY), June 16, 2012.
10. Department of Biology, Microbiology Seminar Series, Indiana University, Bloomington (IN), March 6, 2012.
11. Department of Microbiology, Miami University, Oxford (OH), February 8, 2012.
12. Novartis Institutes for Biomedical Research, Emeryville (CA), September 28, 2011.
13. Department of Biochemistry, Ohio State University, Columbus (OH), May 6, 2011.
14. Center for Microbial Pathogenesis, The Research Institute at Nationwide Children's Hospital, Columbus (OH), March 2, 2011.
15. Center for Microbial Interface Biology, Ohio State University Medical Center, Columbus (OH), February 14, 2011.
16. Department of Microbiology and Immunology, Uniformed Services University of the Health Sciences, Bethesda (MD), March 29, 2010. Seminar and class lecture.
17. Department of Microbiology, University of Pennsylvania, Philadelphia (PA), January 16, 2009.
18. Department of Medical Microbiology & Immunology, University of Wisconsin, Madison (WI), December 5, 2008.
19. Christian De Duve Institute of Cellular Pathology, Universite Catholique de Louvain, August 30, 2007. Brussels, Belgium.

## **INVITED PRESENTATIONS AT SCIENTIFIC MEETINGS**

1. Protein Transport Across Cell Membranes Gordon Conference, 2014. Hotel Galvez, Galveston, TX. Invited speaker.
2. XII Pan-American Biochemistry and Molecular Biology Congress, 2013. Puerto Varas (Chile), Invited speaker.
3. Molecular Genetics of Bacteria and Phages Meeting, 2013. University of Wisconsin, Madison, WI. Invited speaker and chair of "Life Beyond the Cytosol" session.
4. Midwest Microbial Pathogenesis Conference, 2011. University of Michigan, Ann Arbor, MI. Invited speaker.
5. Biogenesis of the Bacterial Cell Surface Symposium, ASM General Meeting, 2011. New Orleans, LA. Invited speaker and co-chair of symposium.
6. Ohio Branch of the American Society for Microbiology Annual Meeting, 2011. Ohio University, Athens, OH. Invited speaker.
7. Microbial Stress Response Gordon Research Conference, 2010. Mount Holyoke College, South Hadley, MA. Invited speaker.
8. Bacterial Cell Surfaces Gordon Research Conference, 2010. Colby-Sawyer College, New London, NH. Invited chair for the *Outer Membrane* section.

9. FASEB Summer Research Conference: Transport ATPases: From Molecules to Maladies, 2010. Snowmass Village, CO. Invited speaker.
10. Cellular Lipid Transport - Connecting Fundamental Membrane Assembly Processes to Human Disease, 2008. Canmore, Alberta, Canada. Invited speaker.
11. ASBMB General Meeting, *Membrane Biogenesis* Symposium, 2007. Washington D.C. Invited speaker.

## **ADDITIONAL PRESENTATIONS AT SCIENTIFIC MEETINGS**

1. Bacterial Cell Surfaces Gordon Conference, 2014. West Dover, VT. MurJ is the flippase of lipid-linked precursors for peptidoglycan biogenesis in *E. coli*. Speaker (talk selected from poster abstracts) and poster presenter.
2. Genetic Approaches to Understanding Complex Cellular Processes Conference, 2013. Understanding MurJ function through a SCAM. Sedona, AZ. Speaker.
3. Bacterial Cell Surfaces Gordon Conference, 2012. West Dover, VT. Regulation of cell size in response to nutrient availability by fatty acid biosynthesis in *Escherichia coli*. Poster presenter.
4. Bacterial Cell Surfaces Gordon Conference, 2008. Colby-Sawyer College, New London, NH. Identification of two inner-membrane proteins required for the transport of lipopolysaccharide to the outer membrane of *Escherichia coli*. Poster presenter.
5. Bacterial Cell Surfaces Gordon Conference, 2006. Colby-Sawyer College, New London, NH. A suppressor of lethality in *rpoE* mutants downregulates extracytoplasmic stress responses and outer membrane vesicle production. Poster presenter.
6. Protein Transport Across Cell Membranes Gordon Conference, 2005. Colby-Sawyer College, New London, NH. A chemical genetics approach to study outer membrane biogenesis. Speaker.
7. Microbial Genetics and Genomics III, 2005. Moab, UT. Outer membrane biogenesis in *Escherichia coli*. Speaker.
8. Princeton University Department of Molecular Biology Retreat, 2004. Avalon, NJ. Coordination of outer membrane biogenesis in *Escherichia coli*. Speaker.
9. Bacterial Cell Surfaces Gordon Conference, 2004. New London, NH. Suppressor analysis of *Escherichia coli* mutants with increased outer membrane permeability. Poster presenter.
10. Molecular Genetics of Bacteria and Phages Meeting, 2003. Madison, WI. Constitutive activation of the *Escherichia coli* PHO regulon upregulates *rpoS* translation in an Hfq-dependent fashion. Poster presenter.
11. Molecular Genetics of Bacteria and Phages Meeting, 2000. Cold Spring Harbor, NY. Studies on the transcription of the RpoS regulator SprE. Poster presenter.
12. Molecular Genetics of Microbial Systems Meeting, 1999. Amalfi, Italy. The role of the *crl* locus in the post-translational regulation of RpoS. Poster presenter.