

## Joseph A. Sorg, Ph.D

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Texas A&M University  
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### EDUCATION AND POSITIONS

#### **TEXAS A&M UNIVERSITY, College Station, TX**

Associate Professor:	Department of Biology	09/16 - present
Assistant Professor:	Department of Biology	11/10- 09/16
Joint Appointment:	Department of Microbial Pathogenesis and Immunology	2/16-present

#### **TUFTS UNIVERSITY SCHOOL OF MEDICINE, Boston, MA**

Postdoctoral Fellow:	Department of Molecular Biology and Microbiology	2006-2010
Fellowship Topic:	Germination and pathogenesis of <i>Clostridium difficile</i>	
Advisor:	Dr. Abraham L. Sonenshein	

#### **THE UNIVERSITY OF CHICAGO, Chicago, IL**

Doctor of Philosophy:	Microbiology	2001 - 2006
Dissertation Topic:	Type III secretion blockades in <i>Yersinia</i> spp.	
Advisor:	Dr. Olaf Schneewind	

#### **PURDUE UNIVERSITY, West Lafayette, IN**

Bachelor of Science:	Biochemistry	1997 - 2001
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### PUBLICATIONS

#### Original Research Articles:

- 1) Cambronne, ED., **Sorg, JA.**, Schneewind O. (2004). Binding of SycH chaperone to YscM1 and YscM2 activates effector *yop* expression in *Yersinia enterocolitica*. J. Bacteriol. 186(3):829-41. PMC321491.
- 2) Goss, JW.,\* **Sorg, JA.**,\* Ramamurthi, KS., Ton-That, H., Schneewind O. (2004). The secretion signal of YopN, a regulatory protein of the *Yersinia enterocolitica* type III secretion pathway. J Bacteriol. 2004 Sep;186(18):6320-4. PMC515147.  
\*These authors contributed equally to this work
- 3) **Sorg, JA.**, Miller, NC., Marketon, MM., Schneewind, O. (2005). Rejection of Impassible Substrates by *Yersinia* Type III Secretion Machines. J. Bacteriol. 2005 Oct; 187(20): 7090-102. PMC1251613.
- 4) **Sorg, JA.**, Blaylock, B., Schneewind, O. (2006). Signal Peptide Recognition by YscN, the *Yersinia* Type III Secretion ATPase. PNAS. 2006 Oct; 103(44): 16490-16495. PMC1637609.
- 5) **Sorg, JA.** and Sonenshein, AL. (2008). Bile salts and glycine as co-germinants for *Clostridium difficile* spores. J. Bacteriol. 2008 April; 190(7): 2505-12. PMC2293200.
- 6) Riordan, KE., **Sorg, JA.**, Berube, BJ., Schneewind, O. (2008). Impassable YscP substrates and their impact on the *Yersinia enterocolitica* type III pathway. J. Bacteriol. 2008 Sep; 190(18): 6204-16. PMC2546781.
- 7) Blaylock B., **Sorg, JA.**, Schneewind, O. (2008). *Yersinia enterocolitica* type III secretion of YopR requires a structure in its mRNA. Mol. Microbiol. 2008. Dec; 70(5): 1210-22. PMC2990915.

- 8) **Sorg, JA.** and Sonenshein, AL. (2009). Chenodeoxycholate is an inhibitor of *Clostridium difficile* spore germination. *J. Bacteriol.* 2009. Feb;191(3): 1115-1117. PMC2632082.
- 9) Giel, JL., **Sorg, JA.**, Sonenshein, AL., Zhu, J. (2010). Metabolism of bile salts in mice influences spore germination in *Clostridium difficile*. *PLoS One.* 2010. Jan 15;5(1):e8740. PMC2806926.
- 10) **Sorg, JA.** and Sonenshein, AL. (2010). Inhibiting the initiation of *Clostridium difficile* spore germination using analogs of chenodeoxycholic acid, a bile acid. *J. Bacteriol.* 2010. Oct;192(190): 4983-90. PMC2944524.
- 11) Allen, CA., Babakhani, F., Sears, P., Nguyen, L., **Sorg, JA.** (2013). Both Fidaxomicin and Vancomycin Inhibit Outgrowth of *Clostridium difficile* spores. *Antimicrob. Agents Chemother.* 2013. Jan. 57(1):664. PMC3535933
- 12) Richter, SG., Elli, D., Kim, HK., Hendrickx, APA., **Sorg, JA.**, Schneewind, O., Missiakas, D. (2013). Small molecule inhibitor of lipoteichoic acid synthesis is an antibiotic for Gram-positive bacteria. *PNAS.* 2013 Feb 26; 110(9): 3531-6. PMC3587227
- 13) Chen, S., Wilson-Stanford, S., Cromwell, W., Hillman, JD., Guerrero, A., Allen, CA., **Sorg, JA.**, Smith, L. (2013) Characterization of Site Directed Mutations in the Lanthipeptide Mutacin 1140. *Appl Environ Microbiol.* 2013 Jul; 79(13): 4015-23. PMC3697549.
- 14) Francis, MB., Allen, CA., Shrestha, R., **Sorg, JA.** (2013) Bile Acid Recognition by the *Clostridium difficile* Germinant Receptor, CspC, Is Important for Establishing Infection. *PLoS Pathog.* 2013. 9(5): e1003356. doi:10.1371/journal.ppat.1003356. PMC3649964.
- 15) Francis, MB., Allen, CA, **Sorg, JA.** (2013) Muricholic acids inhibit *Clostridium difficile* spore germination and growth. *PLoS ONE.* 2013. Sep 9;8(9):e73653. doi: 10.1371/journal.pone.0073653. PMC3767737.
- 16) Francis, MB., Allen, CA., **Sorg, JA.** (2015) Spore cortex hydrolysis precedes DPA release during *Clostridium difficile* spore germination. *J Bacteriol.* 2015 Jul;197(14):2276-83. doi: 10.1128/JB.02575-14 (PMC4524186)
- 17) Bouillaut, L., McBride, S., **Sorg, JA.**, Schmidt, DJ., Suarez, JM., Tzipori, S., Mascio, C., Chesnel, L., Sonenshein, AL. (2015). Effects of Surotomycin on *Clostridium difficile* Viability and Toxin Production In Vitro. *Antimicrob Agents Chemother.* 2015 Jul;59(7):4199-205. doi: 10.1128/AAC.00275-15 (PMC4468702)
- 18) Fimlaid, KA., Jensen, O., Donnelly, ML., Francis, MB., **Sorg, JA.**, Shen, A. (2015) Identification of a novel lipoprotein regulator of *Clostridium difficile* spore germination. *PLoS Pathog.* 2015 Oct 23;11(10):e1005239. doi: 10.1371/journal.ppat.1005239. (PMC4619724)
- 19) Bhattacharjee, D., Francis, MB., Ding, X., McAllister, KN., Shrestha, R., **Sorg, JA.**, (2015) Re-examining the germination phenotypes of several *Clostridium difficile* strains suggests another role for the CspC germinant receptor. *J Bacteriol.* 2016 March; 198(5): 777-786 (PMC4810609)
- 20) Francis, MB., **Sorg, JA.** (2016) Dipicolinic acid release by germinating *Clostridium difficile* spores occurs through a mechanosensing mechanism. *mSphere.* 2016 Dec 14;1(6). pii: e00306-16
- 21) Girinathan, BP., Monot, M., Boyle, D., McAllister, KN., **Sorg, JA.**, Dupuy, B., Govind, R. (2017) Effect of *tcdR* Mutation on Sporulation in the Epidemic *Clostridium difficile* Strain R20291. *mSphere.* 2017 Feb 15;2(1) pii: e00383-16. doi: 10.1128/mSphere.00383-16
- 22) Shrestha, R., Lockless, SW., **Sorg, JA.** (2017) A *Clostridium difficile* alanine racemase affects spore germination and accommodates serine as a substrate. *J Biol Chem.* 2017 Jun 23;292(25):10735-10742. doi: 10.1074/jbc.M117.791749. Epub 2017 May 9.
- 23) McAllister, KN., Bouillaut, L., Kahn, JN., Self, WT., **Sorg, JA.** Using CRISPR-Cas9-mediated genome editing to generate *C. difficile* mutants defective in selenoproteins synthesis. *Sci Rep.* 2017 Nov 7;7(1):14672. doi: 10.1038/s41598-017-15236-5.
- 24) Shrestha, R., **Sorg, JA.** Hierarchical recognition of amino acid co-germinants during *Clostridioides difficile* spore germination. *Anaerobe.* 2017 Dec 6;49:41-47. doi: 10.1016/j.anaerobe.2017.12.001.

- 25) Bhattacharjee, D., **Sorg, JA.** Conservation of the “outside – in” germination pathway in *Paraclostridium bifermentans*. 2018. *Front. Microbiol.* 9:2487. doi: 10.3389/fmicb.2018.02487 (PMC In progress)

**Reviews:**

- 26) **Sorg, JA.**, Miller, NC., Schneewind, O. (2005). Substrate recognition of type III secretion machines- testing the RNA signal hypothesis. *Cellular Microbiology.* 2005 Sep;7(9):1217-25. (PMC In progress)
- 27) Paredes-Sabja, D., Shen, A., **Sorg, JA.** (2014) *Clostridium difficile* spore biology: sporulation, germination and spore structural proteins. *Trends Microbiol.* pii: S0966-842X(14)00074-2. doi: 10.1016/j.tim.2014.04.003. (PMC In progress)
- 28) Bhattacharjee, D., McAllister, KN., **Sorg, JA.** (2016) Germinants and their receptors in clostridia. *J. Bacteriol.* In press. 18 July 2016 , doi:10.1128/JB.00405-16
- 29) Zhu, D., **Sorg, JA.**, Sun, X. (2018) *Clostridioides difficile* biology: sporulation, germination, and corresponding therapies for *C. difficile* infection. *Front Cell Infect Microbiol.* 2018 Feb 8;8:29. doi: 10.3389/fcimb.2018.00029. (PMC5809512)

**Books, protocols or other:**

- 30) **Sorg, JA.** \* and Dineen, SS. (2009). Laboratory Maintenance of *Clostridium difficile*. *Curr Protoc Microbiol.* 2009. Feb; Chapter 9: Unit 9A.1. (PMC In progress)  
\*Corresponding author
- 31) Bouillaut, L., McBride, SM., **Sorg, JA.** (2011). Genetic Manipulation of *Clostridium difficile*. *Curr Protoc Microbiol.* 2011. Feb; Chapter 9:Unit 9A.2. (PMC In progress)
- 32) **Sorg, JA.** (2011). “Clostridium.” *World Book Advanced.* World Book, 2011. Web. 7 Nov. 2011.
- 33) Francis, MB., **Sorg, JA.** (2013) EMS Mutagenesis of *Clostridium difficile* to Identify Strains with Germination-null Phenotypes. *Bio-protocols.org* (ISN: 2331-8325).
- 34) Francis, MB., **Sorg, JA.** (2013) Virulence Studies of *Clostridium difficile*. *Bio-protocols.org* (ISSN: 2331-8325).
- 35) **Sorg, JA.** (2014). Microbial Bile Acid Metabolic Clusters: The Bouncers at the Bar. *Cell Host & Microbe.* Invited preview. Nov 12;16(5):551-2.
- 36) Francis, MB., **Sorg, JA.** (2016) Detecting cortex fragments during bacterial spore germination. *J Vis Exp.* 2016 Jun 25;(112). doi: 10.3791/54146.

**Complete List of Published Work in MyBibliography:**

<http://www.ncbi.nlm.nih.gov/sites/myncbi/joseph.sorg.1/bibliography/40274040/public/?sort=date&direction=ascending>

**FUNDING**

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**In Progress:**

**Texas A&M College of Science: STRP** – Role of circadian rhythms in the susceptibility to *C. difficile* infection (Role: PI)

**NIH / NIAID: R43** – Novel anti-infectives for *C. difficile* infection 08/03/2017 – 04/30/2018 (1R43AI132058-01; Role: Collaborator) In no-cost extension.

**NIH / NIAID: RO1** – Mechanisms of *Clostridium difficile* spore germination. 04/01/15 – 03/31/20. (1R01AI116895-01; Role: PI)

**NIH / NIAID: U01** – Decoding Antibiotic-induced Susceptibility to *Clostridium difficile* infection. 08/20/2016 – 7/31/2021. (1U01AI124290-01; Role: Co-PI)

**NIH / NIAID: R15** – Alternate roles of *C. difficile* TcdR. 01/01/2016 – 12/31/2018  
(1R15AI122173-01; Role: Collaborator)

**Completed:**

**Texas A&M University CST\*R Pilot Study Program** – Non-Antibiotic Based Therapeutics for *Clostridium difficile* infection. 12/2015 – 11/2016. (Role: Co-PI)

**NIH / NIAID: R21** - Role of Bile Acids in Human Susceptibility to *Clostridium difficile* Infection. 07/01/13 – 11/15/15 (1R21AI107640-01 (MPI))

**NIH / NIAID: R56** – Characterization of *Clostridium difficile* spore germination. 08/01/14 – 07/31/15 (1R56AI108987-01)

**American Heart Association National Scientist Development Grant** 07/01/11 – 06/31/15  
*Analysis of Clostridium difficile spore germination* (11SDG7160013; Role: PI)

**Sponsored Research – Optimer Pharmaceuticals** 05/11 – 09/11

**Sponsored Research – Cubist Pharmaceuticals** 06/12 – 03/13

**INVITED SPEAKER**

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**Sorg, JA.** (2018) The requirement for the amino acid co-germinant during *C. difficile* spore germination is influenced by mutations in *yabG* and *cspA*. International conference on Gram Positive Pathogens. Omaha, NE.

**Sorg, JA.** (2018) Pseudoprotease regulation of *Clostridium difficile* spore germination. Vanderbilt University

**Sorg, JA.** (2018) CRISPR-Cas9 mutagenesis in *C. difficile*. 6<sup>th</sup> International *Clostridium difficile* Symposium. Bled, Slovenia.

**Sorg, JA.** (2018). *C. difficile* biology. The Rockefeller University.

**Sorg, JA.** (2017) Dissecting the mechanism of *Clostridium difficile* spore germination. University of Iowa.

**Sorg, JA.** (2017) Investigating the mechanisms of *Clostridium difficile* spore germination. University of Southern Illinois.

**Sorg, JA.** (2017) Conservation of a novel spore germination pathway outside of *Clostridioides difficile*. ClostPath 2017. Ann Arbor, MI.

**Sorg, JA.** (2017) Mechanisms of *Clostridium difficile* spore germination. Texas A&M Health Science Center. College Station, TX.

**Sorg, JA.** (2016) Dissecting the early stages of *Clostridium difficile* spore germination. Burnett School of Biomedical Sciences, University of Central Florida, Orlando, FL.

**Sorg, JA.** (2016) Dissecting the mechanism of DPA release during *Clostridium difficile* spore germination. International Conference on Gram-positive Pathogens, Omaha, NE.

**Sorg, JA.** (2016) Dissecting the early stages of *Clostridium difficile* spore germination. Department of Molecular Medicine. University of South Florida, Tampa, FL.

**Sorg, JA.** (2016) Dissecting the early stages of *Clostridium difficile* spore germination. Department of Microbiology & Immunology. Montana State University, Bozeman, MT.

**Sorg, JA.** (2016) Re-examining the germination phenotypes of several *C. difficile* strains. *C. difficile* Anaerobe. Nashville, TN.

**Sorg JA.** (2016) Sporulation and germination in Gram-positive bacteria. Janssen (Johnson & Johnson), Horsham, PA.

**Sorg, JA.** (2015) Re-examining the germination phenotypes of several *C. difficile* strains. *C. difficile* Gulf Coast Collaborative, Houston TX.

**Sorg, JA.** (2015) Re-establishing the importance of bile acids for *Clostridium difficile* spore germination. Texas A&M Health Science Center. Department of Microbial Pathogenesis & Immunology.

**Sorg, JA.** (2015) Targeting *Clostridium difficile* spore germination as a strategy to prevent infection. Loyola University Chicago. Department of Microbiology / Immunology.

**Sorg, JA.** (2015) Targeting *Clostridium difficile* spore germination as a strategy to prevent infection. Merck.

**Sorg, JA.** (2015) Spore cortex hydrolysis precedes DPA release during *C. difficile* spore germination. 5<sup>th</sup> International *Clostridium difficile* Symposium. Bled, Slovenia

**Sorg, JA.** (2015) Identification of the *Clostridium difficile* bile acid germinant receptor reveals a novel pathway for spore germination. The University of VT. Department of Microbiology & Molecular Genetics.

**Sorg, JA.** (2014) Targeting spore germination in CDI. *C. difficile* Gulf Coast Collaborative, Houston, TX

**Sorg, JA.** (2014) Novel Mechanisms of *Clostridium difficile* spore germination. The American Society for Microbiology – Texas Branch Meeting.

**Sorg, JA.** (2014) Identification of the *Clostridium difficile* bile acid germinant receptor reveals a novel pathway for spore germination. The University of Texas Health Science Center at Houston. Department of Microbiology & Molecular Genetics.

**Sorg, JA.** (2014) Defining the early stages of *Clostridium difficile* spore germination. The 11<sup>th</sup> Biennial Congress of the Anaerobe Society of the Americas. Chicago, IL.

**Sorg, JA.** (2013) Spore germination and bile acid resistance in *Clostridium difficile*. *C. difficile* Gulf Coast Collaborative. Houston, TX.

**Sorg, JA.** (2013). Defining the interactions between bile acids and the *C. difficile* germinant receptor, CspC. 2013 ClostPath. Cairns, Australia.

**Sorg, JA.** (2012). Identifying factors that influence *Clostridium difficile* spore germination. 4<sup>th</sup> International Gram-Positive Pathogens Meeting. Omaha, NE.

**Sorg, JA.** (2012). Identifying factors that influence *Clostridium difficile* spore germination. 4<sup>th</sup> International *Clostridium difficile* Symposium. Bled, Slovenia

**Sorg, JA.** (2011). Characterizing the interaction of *Clostridium difficile* with bile acids during spore germination and pathogenesis. Texas A&M University, Department of Biochemistry & Biophysics.

**Sorg, JA.** (2011). Inhibiting the initiation of *Clostridium difficile* spore germination using bile acid analogs. 111<sup>th</sup> American Society for Microbiology General Meeting. New Orleans, LA.

**Sorg, JA.** (2009). Activation and Inhibition of *Clostridium difficile* spore germination. 2009 Boston Bacterial Meeting, Boston, MA.

**Sorg, JA.** (2003). Sticky *Yersinia*: The Role of Adhesins in *Yersinia* Pathogenesis. Wind River Conference on Prokaryotic Biology. Estes Park, CO.

## **MEETING PRESENTATIONS**

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**Sorg, JA.** (2017) Testing the requirements of *C. difficile* infection in the Cyp8b1 mouse. University of Michigan U01 consortium meeting.

Ding, X., Francis, MB., **Sorg, JA.** Characterizing the impact of germinant receptor levels on *Clostridium difficile* spore germination. 2014. International Conference of Gram-positive Pathogens. Omaha, NE.

Francis, MB., Allen, CA., Shrestha, R., **Sorg, JA.** Bile acid recognition by the *Clostridium difficile* germinant receptor, CspC, is important for establishing infection. Int. Conference on Gram-positive microorganisms. 2013. Monte-Catini, Italy.

Allen, CA., Chesnel, L., **Sorg, JA.** Analyzing the effects of surotomycin on *Clostridium difficile* spore germination and outgrowth. 2013 ICCAC. Denver, CO.

Sorg, JA., Nguyen, L., Sonenshein, AL., Sears, P., Babakhani, F. Effect of fidaxomicin on *C. difficile* spore germination and outgrowth. 2012. ECCMID. London, UK.

Allen, CA., **Sorg, JA.**, Effects of increased fecal chenodeoxycholic acid levels on *Clostridium difficile* virulence. 2011 ClostPath Meeting. Ames, IA.

**Sorg, JA.**, Sonenshein, AL. Inhibition of *Clostridium difficile* spore germination by chemical analogs of chenodeoxycholate. The 10<sup>th</sup> Biennial Congress of the Anaerobe Society of the Americas. Philadelphia, PA.

**Sorg, JA.**, Sonenshein, AL. (2009). Activation and Inhibition of *Clostridium difficile* spore germination. 2009 ClostPath Meeting. Rome, Italy.

**Sorg, JA.**, Sonenshein, AL. (2009). Inhibiting germination by spores of the 'superbug' *Clostridium difficile*. 2009 IRACDA Conference. San Francisco, CA.

**Sorg, JA.**, Sonenshein, AL. (2008). Chenodeoxycholate is an inhibitor of *Clostridium difficile* spore germination. 2008. NIH Workshop on Diagnoses and Treatment of *Clostridium difficile* Infection. Bethesda, MD.

**Sorg, JA.**, Sonenshein, AL. (2008). Bile salts and glycine as co-germinants for *Clostridium difficile* spores. The 9<sup>th</sup> Biennial Congress of the Anaerobe Society of the Americas. Long Beach, CA.

**Sorg, JA.**, Sonenshein, AL. (2008). Bile salts and glycine as co-germinants for *Clostridium difficile* spores. 2008 IRACDA Conference. Chapel Hill, NC.

**Sorg, JA.**, Sonenshein, AL. (2007). Characterization of Sporulation in *Clostridium difficile*. Second International *Clostridium difficile* Symposium. Maribor, Slovenia.

## TEACHING EXPERIENCE

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### TEXAS A&M UNIVERSITY, College Station, TX

**Faculty,** Biology 351 (Microbiology) Spring Semester  
Biology/Gene 406 (Bacterial Genetics) Spring Semester

### BUNKER HILL COMMUNITY COLLEGE, Charlestown, MA

**Adjunct Faculty,** Biology 205 (Microbiology) Fall 2008  
(Teaching Mentor: Dr. Nicole Guilmette)

### THE UNIVERSITY OF CHICAGO, Chicago, IL

**Teaching Assistant,** Bacterial Physiology Laboratory Course Winter 2003  
(Instructor: Dr. Tom Christianson)

### THE UNIVERSITY OF CHICAGO, Chicago, IL

**Teaching Assistant,** Molecular Basis of Bacterial Pathogenesis Spring 2003  
(Instructor: Dr. Olaf Schneewind)

## HONORS / AWARDS / FELLOWSHIPS

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- Texas A&M University Montague – CTE Scholar, 2013 – 2014
- NIH Institutional Research and Academic Career Development Award (K12) – Postdoctoral Fellowship (TEACRS), 2007 – 2010

- Molecular and Cell Biology Training Grant, 2002-2005
- Respiratory Biology Research Training Grant, 2001-2002

## **INTELLECTUAL PROPERTY**

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- Methods and Compositions for Inhibiting *Clostridium difficile* Spore Germination and Outgrowth. USP 13/126,687. 11/2/2009.
- Identification of clostridium difficile cspc as a bile acid germinant receptor. PCT/US2013/032464. 9/18/2014.
- Muricholic Acid-Based Compounds as Inhibitors of *Clostridium difficile* Spore Germination. PCT/US2013/070800. 5/28/2015

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## **SERVICE ACTIVITIES**

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- NIAID BACP Study Section 7/18; 10/18
- NIAID Special Emphasis Panel (ZRG IDMB 81) 6/18
- College of Science Strategic Planning Committee, 2017 - 2018
- Department of Biology Graduate Program Committee, 2017 - present
- Department of Biology Seminar Committee, 2015 - present
- Department of Biology Graduate Recruiting and Admissions Committee, 2012 – present
- Department of Biology Student / Postdoc Research Conference Committee, 2012 – 2014
- Ad hoc reviewer for: *Anaerobe*, *Applied and Environmental Microbiology*, *Archives of Microbiolog*, *BMC Research Notes*, *Clinical and Vaccine Immunology*, *Food Microbiology*, *Fronteirs in Microbiology*, *Future Microbiology*, *iConcept*, *Infection & Immunity*, *International Journal of Medical Microbiology*, *Journal of Bacteriology*, *Journal of Clinical Microbiology*, *Journal of Medicinal Chemistry*, *mBio*, *mSphere*, *Pediatric Reports*, *PLoS ONE*, *PLoS Pathogens*, *PNAS*, *Scientific Reports*, *Trends in Microbiology*, *Virulence*.
- *Frontiers in Microbiology* – Microbial Pathogenesis; Associate Editor

## **MEMBERSHIPS IN PROFESSIONAL SOCIETIES**

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ASM – American Society for Microbiology  
ASM – American Society from Microbiology – Texas Branch  
ASA – Anaerobe Soceity of the Americas