

Timothy R. Borgogna

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CURRENT Postdoctoral Researcher, Stewart Lab, Center for Biofilm Engineering – Montana State University

TRAINING Postdoctoral Fellow, Evans Lab, Center for Translational Medicine – University of Montana

EDUCATION Ph.D. Microbiology and Immunology, Montana State University, Bozeman, MT. December 2019.

B.S. Biology, Point Loma Nazarene University, San Diego, CA. May 2014

RESEARCH

Postdoctoral Research II – Stewart Lab, Montana State University, Bozeman, MT (2021-Present)

Mature biofilms on implanted medical devices are resistant to host defenses and antimicrobial therapies. Despite decades of research into biomaterial surfaces aimed at eradicating microbial growth and biofilm establishment, infections remain a significant complication. The increasing rate of surgical intervention necessitates the development of novel insights and strategies to combat device related biofilm infections. To that end, *in vitro* studies in the Stewart Lab have demonstrated that early detection and surveillance of device surfaces by circulating leukocytes drastically enhances biofilm clearance. My current research focusses on translating these *in vitro* findings to an animal model. Recently, we have established a murine subcutaneous implantation model wherein we examine the timing of neutrophil and macrophage recruitment to the implanted surface and surrounding tissue. On-going studies aim to identify the timing and role of leukocyte subpopulations on bacterial clearance and foreign body responses. Future studies will explore the use of selective chemoattractants to recruit specific leukocyte subsets to implantation sites before contaminating bacteria can establish mature biofilms.

Postdoctoral Research I – Evans Lab, University of Montana, Missoula, MT (2020-2021)

Lead immunologist on TRAC-478 Adjuvant Development Contract. This training focussed on the development of synthetic dual TLR4 and TLR7/8 adjuvanted influenza vaccines. Current influenza vaccines fail to provide supra-seasonal or universal protection against circulating influenza viruses. Adjuvants capable of inducing more robust and cross-reactive immune responses to common influenza epitopes provide a critical solution to poor influenza vaccine efficacies. This contract included experimentation towards the production, formulation, and delivery of novel TLR4 and TLR7/8 agonists in combination with various influenza antigens to develop a universal influenza vaccine. Within this contract I oversaw all *in vitro* and *in vivo* screening and testing of lead vaccine candidates. In addition to vaccine development, on-going studies are exploring novel mechanisms of influenza protection through stimulation of TLR7/8.

Doctoral Research – Voyich Lab, Montana State University, Bozeman, MT (2014-2019)

My doctoral research explored the contributions of a primary influenza A infection on the pathogenesis of secondary bacterial pneumonia by *Staphylococcus aureus* (*S. aureus*). Currently, infection with influenza leading to secondary pneumonia is the 8th leading cause of death and the primary preventable disease responsible for recent declines in life expectancy at birth within the United States. My research developed a murine model of secondary infection wherein the role of bacteria virulence gene regulation towards secondary bacterial pneumonia could be assessed. This research identified secondary bacterial pneumonia by *S. aureus* is dependent on the activation of the two-component gene regulatory system SaeR/S. On-going studies suggest components of a healthy lung environment suppress *S. aureus* virulence expression; however, after infection with influenza A, host suppression of virulence is lost, and initiation of pathogenesis ensues. This work was the focus of a provisional patent entitled: “Use of Pulmonary Surfactant Replacement Therapy for Prevention and Treatment of Secondary Pneumonia Following Influenza.”

Undergraduate Research – Cummings Lab, Point Loma Nazarene University, San Diego, CA (May 2012-Aug 2013)

The Cummings Lab focuses on the broad dissemination of antibiotic resistance genes (ARGs) in wetlands impacted by urban run-off. My research focused on the capture and characterization of environmental plasmids carrying extended spectrum beta-lactamase (ESBL) genes. This research significantly increased the total library of known ESBL genes and has had implications towards policy and management of the South Bay International Waste-Water Treatment Plant which lies on the border of San Diego, CA and Tijuana, Mexico.

TEACHING

Fall 2021	Invited Instructor – University of Washington School of Medicine WWAMI program. Bozeman campus.
Spring 2020	Adjunct Assistant Professor/Instructor of Biology – University of Montana Western
Spring 2020	Teacher’s Assistant – Medical Bacteriology Lab. Montana State University Instructor evaluations score: 4.9/5
Fall 2019	Co-Instructor – Journal Club. Montana State University Instructor evaluation score: 5/5
Fall 2019	Invited Instructor – University of Washington School of Medicine WWAMI program. Bozeman campus.
Spring 2019	Teacher’s Assistant – Medical Bacteriology Lab. Montana State University Instructor evaluations score: 4.9/5
Fall 2018	Invited Instructor – University of Washington School of Medicine WWAMI program. Bozeman campus.
Spring 2017	Teacher’s Assistant – Medical Bacteriology Lab. Montana State University Instructor evaluations score: 4.9/5
Spring 2016	Teacher’s Assistant – Medical Bacteriology Lab. Montana State University Instructor evaluations score: 4.7/5
Fall 2012	Teacher’s Assistant – Microbiology of Infectious Disease. Point Loma Nazarene University

Fall 2011

Teacher's Assistant – Microbiology of Infectious Disease. Point Loma
Nazarene University

PATENTS

U.S. Provisional Patent Application No. 62/899,016

J. Voyich, T. Borgogna

“Surfactant to Treat Secondary Lung Infections”

PUBLICATIONS

Borgogna TR., Sanchez-Gonzalez A., Gorham K., Voyich J.M. A Precise Pathogen Delivery and Recovery System for Murine Models of Secondary Bacterial Pneumonia. *Journal of Visualized Experiments*. Sep 21;(151). doi: 10.3791/59566.

Nygaard TK, **Borgogna TR**, Sward EW, et al. Aspartic Acid Residue 51 of SaeR Is Essential for *Staphylococcus aureus* Virulence. *Front Microbiol*. 2018;9:3085. Published 2018 Dec 14. doi:10.3389/fmicb.2018.03085

Timothy R Borgogna, Bennett Hisey, Emily Heitmann, Joshua J Obar, Nicole Meissner, Jovanka M Voyich; Secondary Bacterial Pneumonia by *Staphylococcus aureus* following Influenza A Infection Is SaeR/S Dependent, *The Journal of Infectious Diseases*, jiy210.

Guerra FE, **Borgogna TR**, Patel DM, Sward EW, Voyich JM. Epic Immune Battles of History: Neutrophils vs. *Staphylococcus aureus*. *Front. Cell. Infect. Microbiol.* . 2017. p. 286. Available from: <http://journal.frontiersin.org/article/10.3389/fcimb.2017.00286>

Borgogna Timothy R., Borgogna Joanna-Lynn, Mielke Jenna A., Brown Celeste J., Top Eva M., Botts Ryan T., and Cummings David E. High Diversity of CTX-M Extended-Spectrum β -lactamases in Municipal Wastewater and Urban Wetlands. *Microbial Drug Resistance*. June 2016, 22(4): 312-320

BOOK CHAPTERS

Borgogna Timothy, Voyich Jovanka. Examining the Executioners, Influenza Associated Secondary Bacterial Pneumonia. In: Nima Rezaei editor. *Pneumonia*. Intech Open. 2021

Nygaard TK, **Borgogna TR**, Sward EW, Guerra FE, Dankoff JG, Collins MM, Pallister KB, Chen L, Kreiswirth BN, Voyich JM. Aspartic Acid Residue 51 of SaeR is Essential for *Staphylococcus aureus* Virulence. In: Alexandre Morrot, editor. *Prime Archives in Genomics*. Hyderabad, India: Vide Leaf. 2020.

IN-PREPARATION

Timothy R. Borgogna, Madison M. Collins, Kyle Glose, Willis Pullman, Kyler B. Pallister, Tyler K. Nygaard, Jovanka M. Voyich. Uncovering the executioner: Disruption of Pulmonary Surfactant by Influenza A Triggers *Staphylococcus aureus* Pneumonia. 2021. In preparation.

Pettygrove B, **Borgogna T**, Nygaard T, Malachowa N, Pallister K, DeLeo F, Voyich J, Stewart P. Tolerance to Neutrophil Clearance during Early *S. aureus* biofilm formation is saeR/S dependent.

Alan J. Weaver, Jr., **Timothy R. Borgogna**, Tami R. Peters, Martin Teintze, Valérie Copié, Jovanka Voyich. Treatment of MRSA with 18- β -Glycyrrhetic Acid Reduces Cell-to-Cell Interactions and Increases Staphyloxanthin Production. 2021. In preparation

ACKNOWLEDGMENTS

Criddle A, Thornburg T, Kochetkova I, DePartee M, Taylor MP. gD-Independent Superinfection Exclusion of Alpha herpesviruses. *Journal of Virology*. United States; 2016; 90(8):4049–4058.

AWARDS AND HONORS

- Travel Award – Society for Leukocyte Biology General Meeting (\$720.00), Nov. 2019
- MSU College of Letters and Science Student Research Travel Grant (\$500.00), Sep. 2018
- Kopriva Graduate Student Fellowship (\$5,000.00), Jun. 2018
- Travel Award – Society for Leukocyte Biology General Meeting (\$750.00), Oct. 2017
- Northwest Branch ASM Meeting 2nd Place Poster Presentation (\$100.00) Nov. 2015
- Nominated for AAAS/Science Program for Excellence in Science, Jul. 2014
- WCBSURC Winning Microbiology Oral Presentation (\$100.00) Jun. 2014
- Molecular Sciences Award (\$500.00), Nov. 2013
- Honors Scholars Program, 2012-2014
- Trowbridge Undergraduate Research Scholarship (\$4,500.00), 2012-2014

PRESENTATIONS

Invited

Osher Lifelong Learning Institute, Bozeman, MT. 2022

“Influenza and Bacterial Superinfection: Uncovering the Executioner”

Women in Science and Engineering Conference, Bozeman, MT. 2021

“There and Back Again: A Pandemic Tale”

American Society for Clinical Laboratory Science Montana Spring Meeting, Missoula, MT 2020.

“Uncovering the Executioner: Initiation and Pathogenesis of *Staphylococcus aureus* Pneumonia following Influenza A Infection”

Seminars

Society for Leukocyte Biology General Meeting, Flash Talk, Boston, MA. 2019
“Components of Pulmonary Surfactant Suppress *Staphylococcus aureus* Virulence”

Kopriva Science Seminar Series, Bozeman, MT. 2019
“*Staphylococcus aureus* Pneumonia: Provoking the Executioner”

Research in Progress Seminar, MSU Bozeman, MT. 2019
“Components of the Host Lung Environment Suppress *Staphylococcus aureus* Virulence
– The Other Side of the Coin.”

Research in Progress Seminar, MSU Bozeman, MT. 2016
“Primary Influenza A Infection Triggers *SaeR/S*-Dependent Virulence in *Staphylococcus aureus*”

West Coast Biological Sciences Undergraduate Research Conference, San Diego, CA. 2014
“Detection and Quantification of CTX-M Extended-Spectrum beta-Lactamases in Urban Wetlands and Associated Wastewater Treatment Plants”
- **Microbiology category winning presentation**

West Coast Biological Sciences Undergraduate Research Conference, San Diego, CA. 2013
“Detection and Analysis of blaCTX-M Antibiotic Resistance Genes in Urban Wetlands and Wastewater Treatment Plants in San Diego County”

Posters

Society for Leukocyte Biology Annual Meeting, Boston, MA 2019
“Components of Pulmonary Surfactant Suppress *Staphylococcus aureus* Virulence”

Gordon Research Conference on Staphylococcal Diseases, Barcelona Spain 2019
“Components of the Host Lung Environment Suppress *Staphylococcus aureus* Virulence”

Graduate Research Rendezvous, Bozeman, MT 2017
“Immunological Changes in the Host Lung Environment during Antecedent Influenza A Infection Lead to Expression of *S. aureus* SaeR/S-Dependent Virulence Expression during Secondary Bacterial Pneumonia”

Society for Leukocyte Biology 50th Annual Meeting, Vancouver, CA 2017
“Immunological Changes in the Host Lung Environment during Antecedent Influenza A Infection Lead to Expression of *S. aureus* SaeR/S-Dependent Virulence Expression during Secondary Bacterial Pneumonia”

International Society for Microbial Ecology Meeting, Montreal, Canada 2016
“Antecedent Influenza A Triggers Virulence Gene Expression in *Staphylococcus aureus*”

Northwest Branch American Society for Microbiology Meeting, Seattle, WA 2015

“Understanding Host Responses Triggering Pathogen Virulence During Secondary *Staphylococcus aureus* Pneumonia”

- **2nd Place Presentation**

Society for Leukocyte Biology 48th Annual Meeting, Raleigh, NC 2015

“Understanding Host Responses Triggering Pathogen Virulence During Secondary *Staphylococcus aureus* Pneumonia”

General Meeting American Society for Microbiology, Boston, MA 2014

“Abundance and Diversity of CTX-M Extended-Spectrum β -Lactamases in Urban Wetlands and Associated Waste-Water Treatment Plants”

OUTREACH

Summer 2019

Hopa Mountain Instructor

Hopa Mountain encourages education in rural and tribal communities within Montana. I aided in creating and teaching a brief curriculum designed to engage students in microbiology.

2016-2018

Community Assistant II. Assisted within Montana State University’s Family and Graduate Housing to resolve neighborhood issues including a community watch program, coordinate community activities, resolve noise complaints, dispute resolution, etc. I worked to promote a healthy and friendly community environment for all residing within Family and Graduate Housing.