

Bryan H. Bellaire, PhD, RBP, (SM)NRCM

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Education

- 1995 BS in Microbiology, Northern Arizona University, Flagstaff, Arizona.
- 2001 Ph.D., Microbiology and Immunology, Louisiana State University Health Sciences Center, Shreveport, LA.,
- 2006 Postdoctoral Fellowship, Cellular Microbiology, LSUHSC-Shreveport, LA
- 2016 Certified Biosafety Specialist-National Registry of Certified Microbiologists, American Society for Microbiology [(SM.)NRCM]
- 2016 Registered Biosafety Professional [RBP] American Biological Safety Association

Personal Statement

I have made it my mission to employ sound scientific practices with innovative and novel approaches to identify, illuminate and eliminate pathogenic events underlying persistent microbial infections. My laboratory's primary research goal is understanding interactions between pathogens and the host manifesting into chronic diseases in humans and animals. While focusing on the pathogenesis of chronic intracellular pathogens, our lab has illuminated several factors involving the role of innate immune defenses that fail to limit infection and cannot provide lasting acquired immunity. We are investigating basic bacterial pathogenic mechanisms, the development of antimicrobial resistance and improved antimicrobial delivery methods in treating *Brucella*, *Burkholderia*, and *Mycobacterium*.

In response to the current COVID pandemic, we have advanced our work into SARS Coronavirus pathogenesis to investigate viral processes within the host and investigate methods to inactivate the virus on surfaces and within the host. My research lab has documented SARS_CoV 2 intracellular replication and evaluated several antiviral responses.

My faculty appointment also provides excellent personal and professional satisfaction in teaching and mentoring undergraduate, graduate and veterinary students. These opportunities allow me to expose undergraduates to research by providing them with part-time laboratory or volunteering opportunities. I also take great satisfaction in serving as the BSL3/ABSL3 Laboratory Director, overseeing the implementation of Biosafe and Biosecure practices with highly pathogenic agents.

Relevant Contributions to Science

SARS-huCoV2 antiviral and pathogenesis research. The BSL3/ABSL3 Research Laboratories are a certified high-containment facility that is the site of various infectious disease research investigating the mechanisms of pathogenesis and development of therapeutics and vaccines. Our portfolio of supported projects varies from biowarfare agents and agricultural threats to global health diseases, including SARS-Coronavirus. I have assembled ISU experts to acquire bridging knowledge to conduct in vitro and in vivo virology experiments to meet the expanding needs of researchers investigating the pandemic. We conduct antiviral material testing, in vitro pathogenesis and neutralization assays, and infection studies in hamsters and recombinant murine strains with multiple variant viruses of

SARS-huCoV2. This work was awarded an ISU Presidential Research Impact Award for Exceptional Effort in response to COVID-19.

Vikram Srivastava, Ling Niu, Kruttika Phadke, **Bryan H. Bellaire**, Michael W. Cho. Induction of potent and durable neutralizing antibodies against SARS-CoV-2 using a receptor binding domain-based immunogen. *Front Immunol.* 2021 Mar 11;12:637982. doi: 10.3389/fimmu.2021.637982. eCollection 2021.

Nelli RK, Phadke KS, Castillo G, Yen L, Saunders A, Rauh R, Nelson W, **Bellaire BH**, Giménez-Lirola LG. Enhanced apoptosis as a possible mechanism to self-limit SARS-CoV-2 replication in porcine primary respiratory epithelial cells in contrast to human cells. *Cell Death Discov.* 2021 Dec 10;7(1):383. doi: 10.1038/s41420-021-00781-w.

Intracellular persistence of chronic bacterial pathogens. Bacterial pathogenesis is a complex response to an equally complex environment of host tissues and cells. Intracellular bacteria must withstand extracellular and intracellular host defenses that vary according to the bacteria's microenvironment. Cellular internalization of bacterial pathogens initiates early changes in the immune response leading to intracellular survival and replication. We observe pro-inflammatory responses that improve antimicrobial activity against intracellular bacteria, including *Brucella*, *Burkholderia*, and *Mycobacterium*. In this endeavor, we also discover molecular mechanisms that rescue bacteria from destruction, illustrating the co-evolution of responses each possess for survival. This work forms the cornerstone of our investigation into basic pathogenesis research and informs our research on developing therapeutics directed against such pathogens.

- Lueth, P.A., S.L. Haughney, A.M. Binnebose, A.S. Mullis, N. Peroutka-Bigus, B. Narasimhan and **BH. Bellaire**. Nanotherapeutic provides dose-sparing and improved antimicrobial activity against *Brucella melitensis* infections. Submitted 6/5/2018. *Journal Controlled Release*.
- Ritchie, J.A., A. Rupper, J.A. Cardelli and **BH. Bellaire**. Host Interferon- γ Inducible Protein Contributes to *Brucella* Survival. *Cellular and Infection Microbiology*. 2012;2:55.
- Michael Carruthers, **BH Bellaire** and Chris Minion. 2010. Exploring the response of *Escherichia coli* O157:H7 EDL933 within *Acanthamoeba castellanii* by genome-wide transcriptional profiling. *FEMS Microbiol Lett*; 312(1): 15-23.
- Roux, C.M., NJ. Booth, **B.H. Bellaire**, J.M. Gee, R.M. Roop II, M.E. Kovach, R.M. Tsolis, P.H. Elzer and D.G. Ennis. 2006. RecA and RadA proteins of *Brucella abortus* do not perform overlapping protective DNA repair functions following oxidative burst. *J. Bacteriol.* **188**(14): 5187-5195.
- **Bellaire, B.H.**, R.M. Roop II, J.A. Cardelli. 2005. Opsonized virulent *Brucella abortus* replicate within non-acidic, endoplasmic reticulum negative, LAMP 1 positive phagosomes in human monocytes. *Infect. Immun.* **73**(6): 3702-3713.

Nanoparticles as an effective delivery platform against intracellular bacterial infections. Highly infectious, intracellular bacterial pathogens exhibit many shared virulence properties, leading us to study a range of pathogens from Biowarfare agents (*Brucella*, *Burkholderia*, and *Francisella*) to *Mycobacterium*. The lack of effective treatments, infection relapses, and rising antimicrobial resistance rates led us to study a more effective means to deliver antibiotics to the intracellular site of infection.

- Kelly SM, Larsen KR, Darling R, Petersen AC, **Bellaire BH**, Wannemuehler MJ, Narasimhan B. Single-dose combination nanovaccine induces both rapid and durable humoral immunity and

- toxin neutralizing antibody responses against *Bacillus anthracis*. *Vaccine*. 2021 Jun 29;39(29):3862-3870. doi: 10.1016/j.vaccine.2021.05.077. Epub 2021 Jun 2.
- Davoudi Z, Peroutka-Bigus N, **Bellaire B**, Jergens A, Wannemuehler M, Wang Q. Gut Organoid as a New Platform to Study Alginate and Chitosan Mediated PLGA Nanoparticles for Drug Delivery. *Mar Drugs*. 2021 May 20;19(5):282. doi: 10.3390/md19050282.
 - Peroutka-Bigus N, **Bellaire BH**. Antiparasitic Activity of Auranofin against Pathogenic *Naegleria fowleri*. *J Eukaryot Microbiol*. 2019 Jul;66(4):684-688. doi: 10.1111/jeu.12706. Epub 2019 Jan 11.
 - Phanse Y, Carrillo-Conde BR, Ramer-Tait AE, Roychoudhury R, Broderick S, Pohl N, Rajan K, Narasimhan B, Wannemuehler MJ, Bellaire BH. Functionalization promotes pathogen-mimicking characteristics of polyanhydride nanoparticle adjuvants. *J Biomed Mater Res A*. 2017 Oct;105(10):2762-2771. doi: 10.1002/jbm.a.36128. Epub 2017 Jul 6.
 - Phanse Y, Lueth P, Ramer-Tait AE, Carrillo-Conde BR, Narasimhan B, Wannemuehler MJ and **Bellaire BH**. Evaluating Cellular Interactions of Polyanhydrides for Rational Drug Delivery. *Journal of Biomedical Nanotechnology*. 2015.
 - Phanse, Y., B. Carillo-Conde, A.E. Ramer-Tait, R. Roychoudhury, N.L. Pohl, B. Narasimhan, M.J. Wannemuehler and **BH. Bellaire**. Functionalization of polyanhydride microparticles with di-mannose influences uptake by and intracellular fate within dendritic cells. *Acta Biomater*. 2013 June 21.
 - Ulery, B.D., L.K. Petersen, Y. Phanse, C.S. Kong, S.R. Broderick, D. Kumar, A.E. Ramer-Tait, B. Carillo-Conde, K. Rajan, M.J. Wannemuehler, **B.H. Bellaire**, D. Metzger and **B. Narasimhan**. 2011. Rational Design of Pathogen Mimicking Amphiphilic Materials as Nanoadjuvants. *Nature Scientific Reports*. December 2011.

Professional and Research Experience

- 1994 *DOE Science and Engineering Research Semester Fellow*, Battelle Laboratories, Richland, WA. Performed environmental microbiology research under the direction of Todd Stevens, Ph.D.
- 1995 – 2001: *Doctoral student*, Department of Microbiology and Immunology, Louisiana State University Health Sciences Center, Shreveport, Louisiana. Research directed by R. Marty Roop II, Ph.D.
- 2004-2006: Institutional Biosafety Committee Member
- 2001-2006: Postdoctoral Fellowship NIH NRSA award (F32-AI056965-01)
- 2006 – 2014: Assistant Professor, Department of Veterinary Microbiology and Preventive Medicine, College of Veterinary Medicine, Iowa State University.
- 2009-2015: ISU Faculty Advisor for Microbiology Graduate Student Organization
- 2014-present: Institution Biosafety Committee Member, National Veterinary Services Laboratory, Center for Veterinary Biologics
- 2014–present: Associate Professor, Department of Veterinary Microbiology and Preventive Medicine, College of Veterinary Medicine, Iowa State University.

Professional Societies

- 1994 – Present: American Society for Microbiology
- 1998 – Present: American Association for the Advancement of Science
- 1996 – 1999: Research Workers in Animal Diseases
- 2006 – Present: Midwest Branch of the American Society for Microbiology
- 2009 – Present: Honorary Member of Phi Zeta Veterinary Honors Society

2014-Present: American Biological Safety Association

2018 – Present: National Institute of Antimicrobial Resistance Research and Education

Appointments and Institutional Service

2000-2006: LSUHSC BSL3 Laboratory Manager

2004-2006: LSUHSC Institutional Biosafety Committee

2007-present: ISU BSL3 Laboratory Director

2008-2015: Faculty Advisor for Microbiology Graduate Student Organization

2009-2020: Interdepartmental Immunobiology Steering Committee

2009-Present: Departmental representative for Computer Library Information Management Committee.

2014-Present: College of Veterinary Medicine Safety Committee

2015-Present: USDA-NADC Institutional Biosafety Committee external member

2018-2020: Interdepartmental Microbiology Graduate Program Chair

Teaching Experience

2007 – 2018 Co-CO VMPPM 604 (F; 1 Cr.)

2009 – L – Cellular Microbiology of Innate Immunity IMBIO 520

2010 - 2012 CO Immunobiology Workshop Series (1 Cr.)

2011 – CO VMPPM 586/586L Graduate Veterinary Bacteriology (F; 4 Cr.)

2013 – CO MICRO 302 Undergraduate General Microbiology (F; 3 Cr.)

2015 – 2017 Co-CO MICRO 320 Undergraduate Bacterial Physiology (S; 3 Cr.)

2017 – 2020 CO MICRO 604 Graduate Seminar (S & F; 1 Cr.)

2018 – CO VMPPM 553 Graduate Microbial Pathogenesis (F; 1 Cr.)

2020 – CO VMPPM 625

GRANTS and CONTRACTS

Extramural: Funded

2009 BSL3 Laser Scanning Confocal Microscope for Imaging Live Biodefense Agents *in vitro*. Office of Naval Research. MURI, \$280,000. **Co-PI Bellaire**, PI Minion.

2009 Narasimhan, B.J, and Wannemuehler, M.J. Impact of polymer adjuvant chemistry on adaptive immune mechanisms. NIH-Vaccines Against Microbial Diseases Study Section. \$2,764,345. **Co-PI Bellaire**, PI Narasimhan.

5/1/2013-10/31/2015 Novel antiparasitic drug delivery in the treatment of filarial diseases. Global Exploration Opportunities: Bill and Melinda Gates Foundation. \$100,000. **PI - Bellaire**

7/1/2014-6/30/2015 Efficacy testing of ceramic antimicrobial delivery vehicle in bone against *Staphylococcus aureus*. Awarded by Osteoceramics, **PI-Bellaire**. \$20,000.

1/1/14-12/31/2017 Nanoparticle delivery of antibiotics for disease control in cultured shrimp. PI-Bartholomay, Co-PI Narasimhan and **Bellaire**. USDA \$450,000

9/1/14-8/31/18 Co-PI Enhanced shelf-life nanovaccine formulation for immunity to biodefense pathogens. PI-Narasimhan, Co-PIs Wannemuehler and **Bellaire**. NIH - 1R01AI111466. \$6,084,626

7/1/2017-6/29/2019. Quantifying Targeted Nanotherapy Against Extensively Drug Resistant Tuberculosis. CVM Seed-USDA Formula Funds. \$40,000. **PI-Bellaire**, Co-PI Narasimhan.

10/1/2018 – 9/30/2019. Circulating Diagnostic Markers of Infectious Disease. DoD BARDA STTR Contract. **PI-Bellaire**

- 12/14/2018-12/14/2021. Nanomedicine countermeasures to overcome antimicrobial resistance. DoD Defense Threat Reduction Agency Contract. \$1,479,000. **PI-Bellaire**
- 09/01/2020-12/31/2021. Biomarker discovery for biowarfare agents. DoD. \$100,000. **Co-PI Bellaire**, PI Manohar John.
- 05/12/2020-07/31/2021. Antiviral assessment of Immunocor Inc. therapeutic *in vitro* and *in vivo*. Immunocor, Reno, NV. \$85,000. **PI-Bellaire**
- 10/01/2020-5/30/2021. Antiviral activity testing of metal-oxides. DOE-Oak Ridge/Sandia/Ames Lab. \$25,000. **PI-Bellaire**
- 09/15/2020-6/30/2021. Peptide discovery and vaccine testing against SARS-CoV2 Spike protein. Mayo Clinic-Vaccine Research Group. \$48,000.

Intramural: Funded

- 8/1/2007-6/30/2009 **PI** Healthy Livestock Initiative. Novel Anti-Niche Approach against *Brucella* Infections in Cattle. Funded: 2 years - \$40,000.
- 9/1/2007-8/31/2009 USDA Formula Funds. **Co-PI** Cellular Interactions of *Mycoplasma hyopneumoniae* and Porcine Respiratory Epithelial Cells. Funded: 2 years - \$38,000.
- 1/1/10-12/30/11 USDA Formula Funds. **PI** Treating chronic Brucella infections intracellular delivery of antibiotics using novel hydrophobic nanospheres. # 411-23-05. Funded: 2 years - \$22,000.
- 12/1/2011 – 5/30/2012 **PI** Iowa State University Research Foundation. Antimicrobial Delivery Platform. \$28,000.
- 9/1/2012 **PI.** Health Research Initiative – 2. Development of Antibiotic Delivery focused Grant Proposals. \$48,000
- 07/1/2012 – 06/30/2014. **PI** ISU- College of Veterinary Medicine Seed Grant. Development of a novel antibiotic delivery method for the treatment of *Mycobacterium tuberculosis*. \$40,000
- 10/31/2014-8/28/2015 **PI** Novel antiparasitic drug delivery in the treatment of Tuberculosis Nanovaccine Presidential Initiative \$30,000.
- 2015-6/30/2016. **P.I.** Osteoceramic product testing of antimicrobials. Contract. \$20,000.
- 4/1/2015 – 6/30/2015. **PI** Oral distribution studies of polyanhydride nanoparticles. PIIR. \$20,000.
- 7/1/2017-6/29/2020. **PI** Quantifying Targeted Nanotherapy Against Extensively Drug-Resistant Tuberculosis. CVM Seed-USDA Formula Funds. \$40,000. **-Bellaire**, Co-PI Narasimhan.
- 3/1/2019-3/31/2021. **Co-PI** Pharmacology to Farm-Ecology, developing antimicrobial resistance biomarkers. Presidential Initiative Research Seed. Co-PI Jing-Lee.

Extramural: Not Funded

- 2005 NIH-NIAID Faculty Transition Award. Role of Rab7 during Chronic Persistence in Human Monocytes.
- 2006 Keck Foundation. Novel Treatments against Chronic *Brucellosis* in humans and animals. August. Request: \$900,000.
- 2006 Carver Foundation. Novel Treatments against Chronic Intracellular Pathogens. Request: \$306,000.
- 2007 NIH-R01. Director's New Innovator Award Program. Innovative Treatment Against Persistent Intracellular Bacterial Pathogens. Direct Cost - \$1,480,000 over 5 yrs;
- 2007 NIH-NIAID Midwest Regional Center of Excellence. Novel Antimicrobial Treatments Against Established *Brucella* Infections. New Opportunities Award.
- 2009 **Bellaire, B.H.**, NIH-NIAID Midwest Regional Center of Excellence. Novel Antibiotic delivery platform targeting intracellular *Brucella*. New Opportunities Award. 1 year \$200,000. December 15, 2009.
- 2010 **Bellaire, B.**, Developing Novel Antibiotic Delivery Platform to Eliminate Intracellular Bacteria. NIH-MRCE sub-contract. January 15, 2010.
- 2010 **Bellaire, B.**, Intracellular killing of Biodefense agents mediated by polyanhydride

- nanospheres. NIH NIAID Study Section. \$3,882,737. Submitted June 20, 2010.
- 2011 **Bellaire, B.**, Intercellular spread of *Brucella* through host-derived vesicular blebs. NIH-NIAID-R15. Requested \$300,000 over 2 yrs.
- 2011 **Bellaire, B.**, Killing of intracellular *Brucella* using polyanhydride nanoparticle technology. Midwest Regional Center for Excellence of Biodefense and Emerging Infectious Disease Research. \$100,000. NIH-Developmental Award.
- 2012 **Bellaire, B.**, Intracellular spread of *Brucella* through host-derived vesicular blebs. NIH-NIAID-R15. \$300,000
- 2015 **Bellaire.** Killed Classic Swine Fever Virus vaccine employing nanoparticles. CEEZAD-USDA \$160,000
- 2016 **Bellaire.** Improved treatment against filarial parasites using amphiphilic nanoparticles. Bill and Melinda Gates Foundation. 7/1/2016-9/30/2017. \$1,000,000
- 2016 **Bellaire.** Evolution of pathogenesis and antibiotic resistance in α -proteobacteria. DoD, Discovery Award. \$200,000 over 1.5 years.
- 2018 **Bellaire.** Nanotherapeutic delivery platform against parasitic diseases. NIH Drug Discovery - R01. \$1,500,000 over 5 years.
- 2018 Mellata, M. CoPI Bellaire. Combination vaccine and therapeutic against urinary tract infections. NIH-R21. \$250,000.
- 2019 **Bellaire.** Antimicrobial drug delivery platform treating XDR-Tuberculosis. Department of Defense. \$1,300,000 over 3 years.
- 2020 Koziel, J. **Co-PI Bellaire.** SARS UV inactivation in a hospital setting. Centers for Disease Control invited proposal. \$2,863,669.
- 2020 Gimenez-Lirola, Co-PI Bellaire. Transmission of SARS-huCoV2 in livestock animals. USDA-NIFA. \$396,702.
- 2020 Dong, L. **Co-PI Bellaire.** SARS-Diagnostic Sensor. NIH-R21. \$349,661. *Pending*
- 2020 Cho, M. **Co-PI Bellaire.** SARS-huCoV2 vaccine. NIH-R01. \$3,243,866. *Pending*
- 2020 Miller, A. **Co-PI Bellaire.** Study of frameshift mechanism of SARS-CoV2. \$2,000,000 *Pending*

SCHOLARLY WORKS

Publications

1. **Bellaire, B.H.**, C.L. Baldwin, P.H. Elzer and R.M. Roop II. 1999. The siderophore 2,3-dihydroxybenzoic acid is not required for virulence of *Brucella abortus* in BALB/c mice. *Infect. Immun.* **67**: 2615-2618.
2. Parent, M.A., **Bellaire, B.H.**, Murphy, E.A., R.M. Roop II, P.H. Elzer and C.L. Baldwin. 2002. *Brucella abortus* siderophore 2,3-dihydroxybenzoic acid (DHBA) facilitates intracellular survival of the bacteria. *Microb. Pathog.* **32**(5): 239-248.
3. **Bellaire, B.H.**, P.H. Elzer, SD. Hagius, J.V. Walker, N.J. Booth, MD. Edmonds, C.L. Baldwin, R. Freeland and R.M. Roop II. 2003. Genetic organization and iron-Responsive regulation of the *Brucella abortus* 2,3-dihydroxybenzoic acid biosynthesis operon, a cluster of genes required for wild-type virulence in pregnant cattle. *Infect Immun.* **71**(4): 1794-1803.
4. **Bellaire, B.H.**, P.H. Elzer, C.L. Baldwin, and R.M. Roop II. 2003. Production of the siderophore 2,3-dihydroxybenzoic acid is required for wild-type growth of *Brucella abortus* in the presence of erythritol under low iron conditions in vitro. *Infect Immun.* **71**(5): 2927-832
5. Roop II, RM, **BH. Bellaire**, E. Anderson and JT Paulley. 2004. Iron metabolism in *Brucella*, p. 243-262. *In* I. Lopez-Goni and I. Moriyon (ed.), *Brucella: Molecular and cellular biology*. Horizon Scientific Press.
6. Roop II, RM, **BH. Bellaire**, M.W. Valderas, and J.A. Cardelli. 2004. Adaptation of the brucellae to their intracellular niche. *Mol. Micro.* **52**(3): 621-630.

7. Valderas, MW, R.B. Alcantara, J.B. Baumgartner, **B.H. Bellaire**, G.T. Robertson, W.L. Ng, J.M. Richardson, M.E. Winkler, and R.M. Roop II. 2005. Role of HdeA in acid resistance and virulence in *Brucella abortus* 2308. *Vet. Micro.* **20**;107(3-4): 307-12.
8. **Bellaire, B.H.**, R.M. Roop II, J.A. Cardelli. 2005. Opsonized virulent *Brucella abortus* replicate within non-acidic, endoplasmic reticulum negative, LAMP 1 positive phagosomes in human monocytes. *Infect. Immun.* **73**(6): 3702-3713.
9. Reed, B.C., C. Cefalu, **B.H. Bellaire**, J.A. Cardelli, T. Louis, J. Salamon, M.A. Bloecher and R.C. Bunn. 2005. GLUT1CBP(TIP2/GIPC1) Interactions with GLUT1 and Myosin VI: Evidence Supporting an Adapter Function for GLUT1CBP *Mol. Biol. Cell.* **16**(9): 4183-4201.
10. Roux, C.M., NJ. Booth, **B.H. Bellaire**, J.M. Gee, R.M. Roop II, M.E. Kovach, R.M. Tsois, P.H. Elzer and D.G. Ennis. 2006. RecA and RadA proteins of *Brucella abortus* do not perform overlapping protective DNA repair functions following oxidative burst. *J. Bacteriol.* **188**(14): 5187-5195.
11. Huynh, L. Y., MN Ert, T. Hadfield, W.S. Probert, **Bellaire, B. H.**, M. Dobson, R.J. Burgess, R.S. Weyant, T. Popovic, S. Zanecki, D.M. Wagner, P. Keim, V. St. Georgiev, KA Western, J.J. McGowan. 2008. Multiple locus variable number tandem repeat (VNTR) analysis (MLVA) of *Brucella* spp. identifies species-specific markers and insights into phylogenetic relationships. Humana Press. Totowa, USA. National Institute of Allergy and Infectious Diseases. NIH. Volume 1: *Frontiers in Research.* pp 47-54.
12. Snider, J.L, **BH. Bellaire** and J.A. Cardelli. 2008. The beta1 integrin activates JNK independent of CagA, and JNK activation is required for *Helicobacter pylori* CagA+-induced motility of gastric cancer cells. *J. Cell Biol.* **283**(20): 13952-63.
13. Ulery BD, Phanse Y, Sinha A, Wannemuehler MJ, Narasimhan B, **Bellaire BH.** 2009. Polymer chemistry influences monocytic uptake of polyanhydride nanospheres. *Pharm Res.* Mar;26(3):683-90.
14. *Brucellosis in Large Animals.* Co-Authors: S.C. Olsen, **B.H. Bellaire**, R.M. Roop II, and C.O. Thoen. 2010. In *Pathogenesis of Bacterial Infections in Animals.* Ed. Carlton Gyles, John Prescott, Glenn Songer and Charles Thoen.
15. Michael Carruthers, **BH Bellaire** and Chris Minion. 2010. Exploring the response of *Escherichia coli* O157:H7 EDL933 within *Acanthamoeba castellanii* by genome-wide transcriptional profiling. *FEMS Microbiol Lett*; 312(1): 15-23.
16. Torres, M.P., J.H. Wilson-Welder, S.K. Lopac, Y. Phanse, B. Carrillos-Conde, A.E. Ramer-Tait, **B.H. Bellaire**, M.J. Wannemuehler, and B. Narasimhan. 2011. Polyanhydride microparticles enhance dendritic cell antigen presentation and activation. *Act Bio.* Jul; **7**(7):2857-64.
17. Carrillo-Conde, B., A. Chavez-Santoscoy, Y. Phanse, A.E. Ramer-Tait, N.L. Pohl, M.J. Wannemuehler, **B.H. Bellaire** and B. Narasimhan. Mannose-functionalized "pathogen-like" polyanhydride nanoparticles target C-type lectin receptors on dendritic cells. *Mol Pharm.* 2011 Oct 3;8(5):1877-86.
18. Ulery, B.D., L.K. Petersen, Y. Phanse, C.S. Kong, S.R. Broderick, D. Kumar, A.E. Ramer-Tait, B. Carillo-Conde, K. Rajan, M.J. Wannemuehler, **B.H. Bellaire**, D. Metzger and B. Narasimhan. 2011. Rational Design of Pathogen Mimicking Amphiphilic Materials as Nanoadjuvants. *Sci Rep.* 2011 December 16; 1(198).
19. Phanse, Y., A.E. Ramer-Tait, S.L. Friend, B. Carillo-Conde, P. Lueth. C.J. Oster, G.J. Phillips, B. **Narasimhan, M.J.** Wannemuehler and **BH. Bellaire.** Analyzing cellular internalization of nanoparticles and bacteria by multi-spectral imaging flow cytometry. *Journal of Visualized Experiments.* 2012 June 8;(64):e3884.
20. Ritchie, J.A., A. Rupper, J.A. Cardelli and **BH. Bellaire.** Host Interferon- γ Inducible Protein Contributes to *Brucella* Survival. *Cellular and Infection Microbiology.* 2012;2:55.
21. Klionsky, DJ. *et al.* Autophagy. 2012 Apr;8(4):445-544.

22. Ramer-Tait, AE, S.M. Lei, **B.H. Bellaire**, and J.K. Beetham. Differential Surface Deposition of Complement Proteins on Logarithmic and Stationary Phase *Leishmania chagasi* Promastigotes. *J Parasitol.* 2012. June 4.
23. Phanse, Y., B. Carrillo-Conde, A.E. Ramer-Tait, R. Roychoudhury, N.L. Pohl, B. Narasimhan, M.J. Wannemuehler and **BH. Bellaire**. Functionalization of polyanhydride microparticles with di-mannose influences uptake by and intracellular fate within dendritic cells. *Acta Biomater.* 2013 Nov;9(11):8902-9.
24. Kauffman, L. K., Bjork, J. K., Gallup, J. M., Boggiatto, P. M., **Bellaire, B. H.**, and Petersen, C. A. Early detection of *Brucella canis* via quantitative polymerase chain reaction analysis. *Zoonoses Public Health.* Feb. 2014. 61, 48-54.
25. Boggiatto, P. M., Martinez, P. A., Pullikuth, A., Jones, D. E., **Bellaire, B.**, Catling, A., and Petersen, C. Targeted extracellular signal-regulated kinase activation mediated by *Leishmania amazonensis* requires MP1 scaffold. *Microbes Infect.* Jan. 2014.
26. Gibson-Corley KN, Bockenstedt MM, Li H, Boggiatto PM, Phanse Y, Petersen CA, **Bellaire BH**, Jones DE: An in vitro model of antibody-enhanced killing of the intracellular parasite *Leishmania amazonensis*. *PLoS One* 2014, 9(9).
27. Binnebose A, Martin R, Haughney S, Narasimhan B, **Bellaire BH**. Polyanhydride nanoparticle delivery platform enables enhanced killing of filarial worms. *PLoS Negl Trop Dis.* 2015 October 23;9(10).
28. Ross K, Brenza T, Binnebose A, Phanse Y, Kanthasamy A, Gendelman H, Salem A, Bartholomay L, **Bellaire BH**, Narasimhan B. Nano-enabled Delivery of Diverse Payloads across Complex Biological Barriers. *J Control Release.* 2015 Dec 10;219:548-59.
29. Jeffery U, Kimura K, Gray R, Lueth P, **Bellaire BH**, Roth J, LeVine D. Dogs cast NETs too: canine neutrophil extracellular traps in health and immune-mediated hemolytic anemia. *Journal of Veterinary Immunology and Immunopathology.* 2015 December 15;168(3-4):262-8.
30. Phanse Y, Lueth P, Ramer-Tait AE, Carrillo-Conde BR, Narasimhan B, Wannemuehler MJ and **Bellaire BH**. Cellular Internalization Mechanisms of Polyanhydride Particles: Implications for Rational Design of Drug Delivery Vehicles. *J Biomedical Nanotechnology.* Vol. 12, 2016.
31. Sponseller BA, Clark SK, Gilbertie J, Wong DM, Hepworth K, Wiechert S, Chandramani P, Sponseller BT, Alcott CJ, **Bellaire B**, Petersen AC, Jones DE. Macrophage effector responses of horses are influenced by expression of CD154. *Vet Immunol Immunopathol.* 2016 Nov 1;180:40-44
32. Phanse Y, Carrillo-Conde BR, Ramer-Tait RE Roy R, Broderick S, Pohl N, Rajan K, Narasimhan B, Wannemuehler MJ and **Bellaire, BH**. Functionalization Promotes Pathogen-Mimicking Characteristics of Polyanhydride Nanoparticle Adjuvants. *J Biomed Mater Res A.* 2017 May. Epub 10.1002/jbm.a.36128
33. Bussiere, L. D., Choudhury, P., **Bellaire, B.**, Miller, C. L. Characterization of a Replicating Mammalian Orthoreovirus with Tetracysteine-Tagged muNS for Live-Cell Visualization of Viral Factories. *J. Virology.* November 15, 2017. 10.1128/JVI.01371-17.
34. Davoudi, Z., Peroutka-Bigus, N., **Bellaire, B.**, Wannemuehler, M., Barrett, T. A., Narasimhan, B., Wang, Q. Intestinal organoids containing poly(lactic-co-glycolic acid) nanoparticles for the treatment of inflammatory bowel diseases. *J Biomed Mater Res A.* 2018 April. doi: 10.1002/jbm.a.36305.
35. Qi, Y., Shi, E., Peroutka-Bigus, N., **Bellaire, B.**, Wannemuehler, M., Jergens, A., Barrett, T., Wu, Y., Wang, Q. *Ex Vivo* Study of Telluride Nanowires in Minigut. *J Biomed Nanotechnol.* 2018 June. 10.1166/jbn.2018.2578.
36. Lueth P, Haughney SL, Binnebose AM, Mullis AS, Peroutka-Bigus N, Narasimhan B, **Bellaire BH**. Nanotherapeutic provides dose sparing and improved antimicrobial activity against *Brucella melitensis* infections. *J Control Release.* 2019 January 28;294:288-297. doi: 10.1016/j.jconrel.2018.12.024.

37. Peroutka-Bigus N., **Bellaire B.H.**, Antiparasitic Activity of Auranofin Against Pathogenic *Naegleria fowleri*, *J Eukaryot Microbiol.* 2019 July.
38. Mullis AS, Broderick SR, Binnebose AM, Peroutka-Bigus N, **Bellaire BH**, Rajan K, Narasimhan B. Data Analytics Approach for Rational Design of Nanomedicines with Programmable Drug Release. *Mol Pharm.* 2019 May 6;16(5):1917-1928. doi: 10.1021/acs.molpharmaceut.8b01272.
39. Qi Y, Lohman J, Bratlie KM, Peroutka-Bigus N, **Bellaire B**, Wannemuehler M, Yoon KJ, Barrett TA, Wang Q. Vitamin C and B₃ as new biomaterials to alter intestinal stem cells. *J Biomed Mater Res A.* 2019 Sep;107(9):1886-1897. doi: 10.1002/jbm.a.36715.
40. Wagner DA, Kelly SM, Petersen AC, Peroutka-Bigus N, Darling RJ, **Bellaire BH**, Wannemuehler MJ, Narasimhan B. Single-dose combination nanovaccine induces both rapid and long-lived protection against pneumonic plague. *Acta Biomater.* 2019 Dec;100:326-337. doi: 10.1016/j.actbio.2019.10.016.
41. Mullis, A.S., Peroutka-Bigus, N., Phadke, K.S., **Bellaire, B.H.**, Narasimhan, B. Nanomedicines to counter microbial barriers and antimicrobial resistance *Current Opinion in Chemical Engineering*, 2021, 31, 100672

Invited Lectures

- 2005 Brody School of Medicine, Department of Microbiology. East Carolina University.
- 2005 School of Veterinary Medicine, Department of Veterinary Science. Louisiana State University, Baton Rouge.
- 2005 College of Veterinary Medicine and Biomedical Sciences. Texas A & M University, College Station.
- 2005 Department of Microbiology, College of Veterinary Medicine, Oklahoma State University. Stillwater, OK.
- 2006 Department of Biological Sciences, Texas Tech University. Lubbock, TX.
- 2007 Department of Microbiology, Des Moines University School of Osteopathic Medicine. Des Moines, IA.
- 2014 Defense Threat Reduction Agency, Fort Belvoir, VA.
- 2015 Department of Biochemistry/Biophysics and Molecular Biology, Iowa State University.
- 2016 Purdue College of Veterinary Medicine.
- 2019 Department of Chemistry, Iowa State University.
- 2019 University of Massachusetts Medical Center, Worcester, MA

Honors, Awards and Patents

- 1994 Undergraduate Fellowship: Science and Engineering Research Semester Sponsored by the Department of Energy. January – May.
- 1997 Arnold Ravin – Murial Rogers Fellowship. 41st Annual Wind River Conference on Prokaryotic Biology. June.
- 1998 The Donald E. Kahn Memorial Award for the Outstanding Graduate Student Presentation. 79th Annual Conference for Research Workers in Animal Diseases. November.
- 1998 Arnold Ravin – Murial Rogers Fellowship. 42nd Annual Wind River Conference on Prokaryotic Biology. June.
- 1999 Arnold Ravin – Murial Rogers Fellowship. 43rd Annual Wind River Conference on Prokaryotic Biology. June.
- 2000 Arnold Ravin – Muriel Rogers Fellowship. 44th Annual Wind River Conference on Prokaryotic Biology. June.
- 2000 McCleskey Award for the Outstanding Graduate Student Presentation in Bacteriology. South Central Branch American Society for Microbiology. November.
- 2001 Outstanding Postdoctoral Poster Presentation. Ray A. Barlow Scientific Symposium. January.
- 2002 Arnold Ravin – Murial Rogers Fellowship. 46th Annual Wind River Conference on Prokaryotic Biology. June.
- 2002 Outstanding Postdoctoral Poster Presentation. Ray A. Barlow Scientific Symposium.
- 2003 Travel Award. 1st Annual Mid-Atlantic Microbial Pathogenesis Meeting, Wintergreen, Virginia.
- 2005 Outstanding Postdoctoral Presentation. Graduate Research Day. LSUHSC-Shreveport, May.
- 2006 Arnold Ravin – Murial Rogers Fellowship. 50th Annual Wind River Conference on Prokaryotic Biology. June.
- 2009 Honorary Member of Phi Zeta Veterinary Honors Society
- 2013 Co-Inventor of **Antimicrobial Compositions and Methods**. US Patent 8,449,916.
- 2014 Co-Inventor of **Antimicrobial Polyanhydride and Methods**. US Patent 8,927,024
- 2015 Co-Inventor of **Antiparasitic Polyanhydride Nanoparticles**. US Patent Application 14/614,333.
- 2020 Co-Recipient of ISU Research Impact Award for COVID-19 Exceptional Effort Awards
- 2020 Co-Inventor of Antiviral Materials and Compositions. ISU/Investigative Filing

Selected Published Abstracts

Bellaire, B. H., P. H. Elzer, C. L. Baldwin, and R. M. Roop II. Contribution of the siderophore 2,3-dihydroxybenzoic acid to the pathogenesis of *Brucella abortus* in the BALB/c mouse model. Proc. 78th Annu. Conf. Res. Work. Anim. Dis. 1997; Abstr. 26, p. 17.

Bellaire, B. H., P. L. Schuetze, R. M. Roop II, C. L. Baldwin, and P. H. Elzer. Identification and characterization of a siderophore biosynthesis gene from *Brucella abortus*. 1997. Proc. 77th Annu. Conf. Res. Work. Anim. Dis., Abstr. 3, p. 6.

Bellaire, B. H., R. M. Roop II, C.L. Baldwin and P.H. Elzer. Contribution of the *Brucella abortus* 2,3-dihydroxybenzoic acid (DHBA) biosynthesis operon to virulence in ruminants. Proc. 79th Annu. Conf. Res. Work. Anim. Dis. 1998; Abstr. 4.

Bellaire, B.H., C.L. Baldwin, P.H. Elzer and R.M. Roop II. Genetic organization and Fur-independent regulation of the *Brucella abortus* 2,3-dihydroxybenzoic acid siderophore biosynthesis operon. 44th Annu. Meet. Wind River Conf. Proc. Biol. 2000. Session 6. p. 41.

Bellaire, B.H., C.L. Baldwin, P.H. Elzer and R.M. Roop II. The siderophore 2,3-dihydroxybenzoic acid contributes to the virulence of *Brucella abortus* in ruminants. 100th General Meeting of the American Society for Microbiology. 2000. Abstr.B-17, p.44.

Bellaire, B.H., R.M. Roop II, and J.A. Cardelli. Trafficking and residence of *Brucella abortus* inside human monocytes. 2002. 42nd Annual Meeting for the American Society for Cell Biology. Abstr. B-697.

Bellaire, B.H., R.M. Roop II, and J.A. Cardelli. *Brucella abortus* controls phagosome membrane trafficking events throughout infection in human monocytes. 2003. 43rd Annual Meeting for the American Society for Cell Biology. Abstr. B-523.

Bellaire, B.H., A. Rupper, R.M. Roop II, and J.A. Cardelli. Interferon Gamma Induced Changes in Phagosome Maturation Inhibits the Intracellular Replication of *Brucella* spp. in Human Monocytes. 2005. 105th General Meeting of the American Society for Microbiology. Abstr. B-287.

Bellaire, B.H., A. Rupper, R.M. Roop II, and J.A. Cardelli. Interferon- γ Induced Changes in Phagosome Maturation Inhibits the Intracellular Replication of *Brucella* spp. in Human Monocytes. 2006. Virulence Mechanisms of Bacterial Pathogens International Symposium. Iowa State University.

B Ulery, J Wilson, SA Sarkar, M Torres, S Lopac, A Glowacki, **B Bellaire**, MJ Wannemuehler & B Narasimhan. In Vitro Evaluation of Polyanhydride Nanosphere Interactions with Human and Murine Antigen Presenting Cells. 2008. 6th Annual American Society for Microbiology Biodefense and Emerging Diseases Research Meeting.

Yashdeep Phanse, Jenny Wilson, Balaji Narasimhan, Michael Wannemuehler, and **Bryan H. Bellaire**. Intracellular Stability of Polyanhydrous Microspheres in Murine Dendritic Cells Depends on Polymer Chemistry. Annual Biomaterials May 2009. *National Meeting*-Poster Presentation.

Ana Chavez-Santoscoy, Brenda Carrillo-Conde, Eun-Ho Song, Yashdeep Phanse, Amanda E. Ramer-Tait, Nicola L.B. Pohl, Michael J. Wannemuehler, **Bryan H. Bellaire**, and Balaji Narasimhan. 2010. Targeted activation of antigen presenting cells with mannose-modified polyanhydride nanoparticles. Society for Biomaterials. April.

Phanse, Y., Carrillo-Conde, B.R., Huntimer, L., Ramer-Tait, A., **Bellaire, B.**, Narasimhan, B., Flick, R., Mandell, R., and Wannemuehler, M. 2010. Designing a plague vaccine utilizing α -gal modified antigen. American Association of Immunologists 97th Annual Meeting.

Yashdeep Phanse, Latrisha Petersen, Amanda Ramer-Tait, **B. Bellaire**, Balaji Narasimhan, and Michael Wannemuehler. 2010. Polyanhydride nanoparticle adjuvants for development of a single dose anthrax vaccine. Society for Biomaterials, Seattle, WA; April.

Yashdeep Phanse, Brenda R. Carrillo-Conde, Amanda E Ramer-Tait, Rajarshi Roychoudhuri, Scott Broderick, Nicola Pohl, Krishna Rajan, Balaji Narasimhan, Michael Wannemuehler, and **Bryan Bellaire**. Functionalization of novel polyanhydride nanoparticle adjuvants to promote pathogen-mimicking characteristics. *American Institute of Chemical Engineers*. 2012.

Yashdeep Phanse, Brenda R. Carrillo-Conde, Amanda E Ramer-Tait, Rajarshi Roychoudhuri, Nicola Pohl, Krishna Rajan, Balaji Narasimhan, Michael Wannemuehler, and **Bryan Bellaire**. Functionalization of polyanhydride microparticles influence promoting pathogen-mimicking characteristics. *American Association of Immunology*. 2013.

Phanse Y., P. Lueth, A. Ramer-Tait, B. Carrillo-Conde, B. Narasimhan, M.J. Wannemuehler and **B. H. Bellaire**. Evaluating Cellular Interactions of Polyanhydrides for Rational Drug Delivery. *Society for Biomaterials*. 2013.

Andrea Binnebose, Richard Martin, Shannon Haughney, Balaji Narasimhan, and **Bryan Bellaire**. Polyanhydride nanoparticle delivery platform enables the enhanced killing of filarial worms. Biomedical Engineering Society Meeting. October 2014.

Nathan Peroutka-Bigus, B. Narasimhan, and **B. H. Bellaire**. Nanotherapeutic development against *Burkholderia pseudomallei*. *Chemical and Biological Defense Science and Technology Meeting*. 2019.

Kristina Larsen, Kruttika Phadke, Nathan Peroutka-Bigus and **B. H. Bellaire**. Evolutionary relationship of human pathogen and plant endosymbiont. *American Society for Microbiology Annual Conference* 2020.

Training and Mentorship

One of the greatest joys of being a faculty member is the opportunity to mentor graduate students. I am humbled by my position and experience tremendous professional and personal satisfaction from encouraging, directing, and listening to scientists' next generation. I am incredibly proud of sharing knowledge with the next generation of scientists in advanced microscopy and Biosafety Level 3 research, two extremely beneficial and rare disciplines.

- a. Major PI/Co-Major PI
 - i. Yashdeep Phanse, PhD. Immunobiology (graduated 2012)
 - ii. Jennifer Ritchie, MS. Microbiology (graduated 2011)
 - iii. Paul Lueth, MS. Interdepartmental Graduate Studies (graduated 2017)
 - iv. Andrea Binnebose, PhD. Microbiology (graduated 2018)
 - v. Nathan Peroutka-Bigus, PhD. Microbiology (graduated 2020)
 - vi. Adam Mullis, PhD. Chemical and Biological Engineering (graduated 2020 year)
 - vii. Kristina Larsen, PhD. Microbiology (current 3rd year)

- viii. Kruttika Phadke, PhD, Microbiology (current 3rd year)
- b. POS
 - i. Jing Yu, PhD, Microbiology
 - ii. Colleen Jeffrey, MS, Biomedical Sciences
 - iii. Rocky Patil, MS, Microbiology
 - iv. Jing Yu, PhD, Microbiology
 - v. Bret Daniel Ulery, PhD, Chemical and Biological Engineering
 - vi. Luke Linz, PhD, Biochemistry
 - vii. Stacy Duncan, PhD, Bioinformatics
 - viii. Nakhuung Lee, PhD, Veterinary Microbiology
 - ix. Carry Oster, MS, Veterinary Microbiology
 - x. Alison Cody, MS, Biochemistry
 - xi. Brian Martinson, PhD, Veterinary Microbiology
 - xii. Unity Jeffery, PhD, Veterinary Microbiology
 - xiii. Sri Kanuri, PhD, Biomedical Sciences
- c. Graduate Students
 - i. Dustin Martin, Biochemistry
 - ii. Kathy Mou, Microbiology
 - iii. Paola Boggiatto, PhD, Veterinary Pathology
 - iv. Jason Buehler, PhD, Veterinary Microbiology
 - v. Michael Carruthers, PhD, Microbiology
 - vi. Jenny Wilson-Wielder, PhD, Immunobiology
 - vii. Ana Chavez Santoscoy, MS, Engineering
- d. Veterinary Summer Scholars
 - i. Jennifer Groen-Freitag
 - ii. Allison Hannen (Microscopy Assistance)
 - iii. Amber Cull-Formier (2009)
- e. Undergrads
 - i. Audrienne Freeman (3 yr)
 - ii. Rachel Brown (3 yrs)
 - iii. Rachel Burton (2 yrs)
 - iv. Meghan Fick (2 yrs)
 - v. Gregory Herman (1 yr)
 - vi. Alexandria Burrett (3 yrs)
 - vii. Justin Thoen (1 yr)
 - viii. Micaela Bryant (1 yr)
 - ix. Sophie Young (3 mo)
 - x. Rebecca Burns (3 mo)
 - xi. Taylor Sherman (24 mo)
 - xii. Rachel Powell (6 mo)
- f. High School
 - i. Brianna Galvan, Central Lee HS
 - ii. Alicia Riffle, Central Lee HS
 - iii. Jacob Bedia, Valley HS
 - iv. Abe Brink, Ankeny Centennial HS.
- g. Doctoral Fellows and Professional Staff
 - i. Katherine Gibson-Corley (VPTH)
 - ii. Kevin Esch (VPTH)

iii. Prashanth Chandramani (VMPPM)

2) Journal and Grant Reviews

a. Ad hoc

- i. Public Library of Science One
- ii. Veterinary Microbiology
- iii. Clinical Vaccine Immunology
- iv. Journal of Leukocyte Biology
- v. Microbes and Infections
- vi. Frontiers in Microbiology
- vii. Infection and Immunity
- viii. Science Advances
- ix. Acta Biomaterialia

b. External Grant Reviewer

- i. BARDA (Binational Agricultural Research and Development Fund)
- ii. USDA- Animal Protection and Biosafety
- iii. NIH-Partnerships for Antimicrobial Resistance
- iv. ISU-University of Iowa Partnership
- v. USDA-Animal Research Service Project Review