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**RESEARCH INTERESTS**

Our group at the USDA investigates the development of antibiotic resistant bacteria in food animals which is a major food safety issue. Our goal is to understand how resistance develops in bacteria found in food animals, on farms, in processing plants, in retail foods, and it’s potential to be transmitted to humans through the food chain. My lab focuses on one of the most prevalent foodborne bacterial pathogens, *Salmonella enterica,* which cause about 1.4 million human infections in the U.S. each year. *Salmonella* is known to develop antimicrobial resistance and has the ability to become multi-drug resistant (MDR). To achieve our research goals, we investigate *Salmonella* antimicrobial resistance, epidemiology, genomics, evolution, and pathogenicity. Most of this work is focused on determining the molecular epidemiology of resistance genes and bacteria found in U.S. food animals. We pioneered the utilization of microarrays, next-generation sequencing, and other innovative methods to accomplish these goals. The genes responsible for resistance were identified in commensal and pathogenic bacteria isolated from animals, farms, foods, and humans. These studies found that IncA/C plasmids were responsible for much of the multi drug resistance (MDR) in *Salmonella* and *Escherichia coli* isolated from animals. These plasmids are large (100-200kb), can encode resistance to twelve or more antimicrobials, are self-transmissible, and have been found in bacteria isolated from animals and foods. On-going studies have determined that resistant *Salmonella* isolated from food animals are genetically similar to those found in human disease. Our genomic analysis projects have identified genes in different *Salmonella* serotypes responsible for their variability in host range and pathogenicity, and we have developed assays based on these genetic differences to detect dangerous *Salmonella* serovars like Heidelberg, Paratyphi C, and Typhimurium in food. We also used this data to develop an automated, high-throughput analysis technique to identify the top 100 clinical *Salmonella* serotypes (SMART: *Salmonella* multiplex assay for rapid typing), which is more accurate, easier, quicker, and cheaper than traditional serotyping. We are working with other scientists at USDA, FDA, CDC, Walter Reed, and several U.S. and international universities to use these methods on other important organisms including *Acinetobacter, Campylobacter, Enterococcus, Escherichia coli, Klebsiella,* and MRSA.

**RESEARCH AND PROFESSIONAL EXPERIENCE**

**1993-1995** Research Technician III, University of North Carolina, Chapel Hill. Research focused on identification and characterization of outer membrane proteins of *Treponema pallidum,* the syphilis spirochete.

**1995-2000** Graduate Student, Department of Microbiology, University of Georgia. PhD. Dissertation: Characterization of differential expression of *vlsE*; and σ54 dependent expression of σS in the Lyme disease Spirochete, *Borrelia burgdorferi*.

**2000-2003** Postdoctoral Associate, Sidney Kimmel Cancer Center, San Diego, California. Investigation of *Salmonella* gene expression and genomics.

**2003-Present** Research Microbiologist, Senior Scientist, USDA, Agriculture Research Service, Bacterial Epidemiology and Antimicrobial Resistance Research Unit, Russell Research Center, Athens, GA. Investigation of *Salmonella* antimicrobial resistance, epidemiology, genetics, evolution, gene expression, and pathogenicity.

**2011-present** Adjunct courtesy appointment to the Department of Microbiology at the University of Georgia, Athens, Georgia.

**2014-present** Member of the Integrated Life Sciences faculty at the University of Georgia, Athens, Georgia, in the Pathogens & Immunity interdisciplinary group.

**EDCATION**

**1990-1991** Associate of Applied Science in Biotechnology, 1991 (4.0 GPA) Alamance Community College, Haw River, NC

**1992-1993** Bachelors of Science in Biology, 1993 (4.0 GPA) East Carolina University, Greenville, NC

**1995-2000** Doctorate of Philosophy in Microbiology, 2000 (4.0 GPA) Department of Microbiology, University of Georgia, Athens, GA

**PUBLICATIONS**

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2. *Johny, A.K.,* **J.G. Frye**, A. Donoghue, D.J. Donoghue, S. Porwollik, M. McClelland and K. Venkitanarayanan. 2017. Gene expression response of *Salmonella enterica* serotype Enteritidis phage type 8 to the subinhibitory concentrations of the plant - derived compounds, trans-cinnamaldehyde, and eugenol. Front. Microbiol. Front., 2017 26 September. 8:1828: pp. 1-10. doi: 10.3389/fmicb.2017.01828
3. *Sharma, P.,* S.K. Gupta, E. Adenipekun, J. Barrett, L. Hiott, T. Woodley, B. Iwalokun, K. Oyedeji, A. Oluwadun, H. Ramadan, **J.G. Frye**, and C.R. Jackson. 2017. Draft genome sequence analysis of multidrug-resistant *Escherichia coli* strains isolated in 2013 from humans and chickens in Nigeria. Genome Announc. In press.
4. Bono, A.C., C.E. Hartman, S. Solaimanpour, H. Tong, S. Porwollik, M. McClelland, **J.G. Frye**, J. Mrázeka, A.C. Karls. 2017. Novel DNA binding and regulatory activities for σ54 (RpoN) in *Salmonella* Typhimurium 14028s. J. of Bact. 2017 Apr 3. pii: JB.00816-16. doi: 10.1128/JB.00816-16. [Epub ahead of print]
5. *Gupta, S.K.,* E.A. McMillan, C.R. Jackson, P.T. Desai, S. Porwollik, M. McClelland, L.M. Hiott, S.B. Humayoun, J.B. Barrett, and **J.G. Frye.** 2016. Draft Genome Sequence of *Salmonella enterica* subsp. diarizonae Serovar 61:k:1,5,(7) Strain CRJJGF\_00165 (Phylum Gammaproteobacteria). Genome Announc. 2016 Nov 23;4(6). pii: e01322-16. doi: 10.1128/genomeA.01322-16.
6. Jia, B., A.R. Raphenya, B. Alcock, N. Waglechner, P. Guo, K.K. Tsang, B.A. Lago, B.M. Dave, S. Pereira, A.N. Sharma, S. Doshi, M. Courtot, R. Lo, L.E. Williams, **J.G. Frye**, T. Elsayegh, D. Sardar, E.L. Westman, A.C. Pawlowski, T.A. Johnson, F.S.L. Brinkman, G.D. Wright, A.G. McArthur. 2016. CARD 2017: expansion and model-centric curation of the Comprehensive Antibiotic Resistance Database. Nucleic Acids Res. 2016 Oct 26. pii: gkw1004; doi: 10.1093/nar/gkw1004
7. Berrang, M.E., N.A. Cox, D.E. Cosby, **J.G. Frye**, C.R. Jackson. 2016. Detection of *Salmonella* Serotypes by Overnight Incubation of Entire Broiler Carcass. Journal of Food Safety. In-press.
8. Adenipekun, E.O., C.R. Jackson, H. Ramadan, B.A. Iwalokun, K.S. Oyedeji, **J.G. Frye**, J.B. Barrett, L.M. Hiott, T.A. Woodley, A. Oluwadun. 2016. Prevalence and multidrug resistance of *Escherichia coli* from community-acquired infections in Lagos, Nigeria. 2016. J Infect Dev Ctries. 2016 Sep 30;10(9):920-931. Doi: 10.3855/jidc.7997.
9. *Gupta, S.K.,* E.A. McMillan, C.R. Jackson, P.T. Desai, S. Porwollik, M. McClelland, L.M. Hiott, S.B. Humayoun, and **J.G. Frye.** 2016. Draft Genome Sequence of *Salmonella enterica* subsp. *enterica* Serovar Orion Strain CRJJGF\_00093 (Phylum *Gammaproteobacteria*). Genome Announc. 2016 Sep 29; 4(5). pii: e01063-16. doi:10.1128/genomeA.01063-16.
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**BOOK CHAPTERS**

1. Cox, N., **J.G. Frye**, W. McMahon, D. Cosby, C.R. Jackson. 2013 Chapter 36 *Salmonella*: Rapid Detection Assays in *Compendium of Methods for the Microbiological Examination of Foods, 5th Edition.* Eds. S. Doores, M. L. Tortorello, and B. Wilcke. Xx-xx. American Public Health Association (APHA), Washington, DC, USA In press.
2. **Frye, J.G**. 2012. “Application of MicroArray Technology for Microbial Source Tracking” in *Molecular Typing Methods for Tracking Foodborne Microorganisms.* Eds. S. Foley, R. Nayak, T. Johnson, S. Shukla. Nova Publishing Inc., New York. 319-340. ISBN:978-1-62100-643-5

**POPULAR PRESS ARTICLES**

**Greg Cima.** 2010. “Studies to pinpoint how, when resistance spreads.” Journal of American Veterinary Medical Association News. October 1st, 2010. https://www.avma.org/News/JAVMANews/Pages/101001u.aspx

**Sharon Durham.** 2010. “Genetic Screening Technique Can Detect More Than 700 Antimicrobial-Resistance Genes.” <http://www.ars.usda.gov/is/pr/2010/100526.htm>

**Justin Petrone.** 2005. “ARS' Frye on Developing an Array to Detect Antimicrobial Resistance Genes.” BioArray News. Nov 16;5(44):8-10. <http://www.genomeweb.com/arrays/ars-frye-developing-array-detect-antimicrobial-resistance-genes>

**Sharon Durham.** 2005. “DNA Chips Spot and Help Track Antibiotic Resistance.” Reported by Agricultural Research magazine, Nov;53(11):17. <http://www.ars.usda.gov/is/AR/archive/nov05/dna1105.htm>

**GRADUATE STUDENTS, UNDER GRADUATE STUDENTS, POSTDOCTORAL TRANIES, AND VISITING SCIENTISTS**

**Jennifer Turpin, Ph.D.:** 2004-2005 Dept. of Food Science at UGA, M.S. awarded 2005; 2007-2010 Dept. of Food Science at UGA, Ph.D. awarded 2010; 2010-2011 Postdoctoral Associate.

**LaShanda M. Glenn, Ph.D.:** 2006-2010 Dept. of Food Science at UGA, Ph.D. awarded 2010; 2010-2011 Postdoctoral Associate.

**Laura E. Williams, Ph.D.:** 2013-2014 USDA-ARS, HQ funded Postdoctoral Research Associate – Class of 2012.

**Sohyun Gabi Cho:** 2014-present Dept. of Microbiology at UGA, Ph.D. candidate.

**Elizabeth A. McMillan:** 2014-present Dept. of Microbiology at UGA, Ph.D. candidate.

**Eyitayo O. Adenipekun, Ph.D.:** 2014-2015 visiting scientist from the Department of Medical Microbiology and Parasitology, Olabisi Onabanjo University, College of Health Sciences, Sagamu campus, Sagamu, Ogun-State, Nigeria.

**Sushim Gupta, Ph.D.:** 2015-present Visiting Scientist and Oak Ridge Institute for Science and Education (ORISE) Research Fellow.

**Anh Hoang thi Nguyen:** 2014-2017 Dept. of Microbiology at UGA;Center for Undergraduate Research Opportunities (CURO) Fellowship winner, UGA, 2016-2017. B.S. with honors awarded 2017.

**Poonam Sharma, Ph.D.:** 2017-presentOak Ridge Institute for Science and Education (ORISE) Postdoctoral Fellow.

**Hazem Ramadan, Ph.D.:** 2017-present visiting scientist from the Hygiene and Zoonoses Department, Faculty of Veterinary Medicine, Mansoura University, Mansoura, Egypt.

**TEACHING EXPERIENCE**

**1995-1997** UGA Graduate Teaching Assistant: MIBO 3501L, BIOL 1107L, BIOL 1107, BIOL 1103L, MIBO 4220 and 4230L.

**1997-1998** Teaching Assistant for the Summer Workshop in Microbial Physiology: Pathogenicity of *Salmonella enterica,* serovar Avium in chick embryos.

**2001-2003** Designed and held four, one week workshops on microarray technology and gene expression analysis for visiting professors, scientists, and graduate students at the Sidney Kimmel Cancer Center.

**2009-2014** Hosted visiting scientists from the University of Georgia, FDA, and University of Connecticut for training in microarray detection of antimicrobial resistance genes and analysis of gene expression.

**2013-2014** Hosted graduate student from the University of Georgia for training in molecular serotyping of *Salmonella* using SMART.

**2014** Co-hosted visiting scientists from Nigeria and Egypt for training in the molecular analysis of *Salmonella* and other bacteria isolated from humans, food animals, retail meat, and the environment.

**2015-2016** Developed a laboratory module on the isolation and identification of *Salmonella* from surface water for MIBO3510L at the University of Georgia.

**2016** Presented a lecture to a freshman seminar class (FYOS1001) on education and career planning to become a scientist.

**TRAINING GRANTS, SCHOLARSHIPS, AND FUNDED PROPOSALS**

**1997-1999** Recipient of a competitive National Science Foundation Research Training Grant in Prokaryotic Diversity for the research titled: "Characterization of VlsE, a human tissue culture cell induced protein of *Borrelia burgdorferi*."($18,000/year)

**1999-2000** UGA University-Wide Graduate School Merit Scholarship ($18,000/year)

**2003-2006** ARS project #: 6612-32000-035-00D (Frye co-PI): “Antimicrobial resistance in pathogenic and commensal bacteria of food animals.” (~$1,800,000/year)

**2006-2011** ARS project #: 6612-32000-002-00D (Frye-co-PI) **“**Epidemiology and genetics of antimicrobial resistance in pathogenic and commensal bacteria from food animals.” ($1,604,479.00/year)

**2011-2016** ARS project #: 6612-32000-006-00 (Frye co-PI) “Molecular approaches for the identification and characterization of antimicrobial resistance in foodborne pathogens.” ($1,358,729/year)

**2013-2014** Awarded a competitive USDA-ARS, HQ funded Postdoctoral Research Associate – Class of 2012 (Frye PI) “Characterization of antimicrobial resistance and virulence genes found in bacteria isolated from poultry.” ($50,000/year for two years)

**2014-2016** Foundation for Meat and Poultry Research and Education, ARS project #: 6612-32000-006-01 (Frye PI): “Determination of the prevalence of resistance to biocides in *Salmonella* and identification of genetic mechanisms of resistance.” ($81,771 total).

**2016-2021** ARS project #: 6040-32000-009-00D (Frye co-PI) “Monitoring and Molecular Characterization of Antimicrobial Resistance in Foodborne Bacteria.” ($1,358,729/year)

**2016** ARS ONP special project (Frye PI): “Determining the microbial ecology of antimicrobial resistance (AR) in *Salmonella, Escherichia coli,* and *Enterococcus* present in the Upper Oconee watershed in Georgia.” ($29,485.44)

**2016** ARS ONP special project (Frye co-PI): “A genome-based approach to characterize the mobile antimicrobial resistome in poultry litter.” ($21,000)

**HONORS, AWARDS, AND PROFESSIONAL MEMBERSHIPS**

**1990-1991** Presidents list each quarter at Alamance Community College.

**1992-1993** Chancellors list for each semester at East Carolina University.

**1996** $1000 merit award for outstanding teaching at the University of Georgia.

**1997-present** Member of the American Society for Microbiology.

**1998-present** Member of the American Association for the Advancement of Science.

**2006-2015** Member of the editorial board for the Journal of Clinical Microbiology.

**2011** USDA-ARS Administrators Outreach, Diversity, and Equal Opportunity Award, presented for outstanding workforce diversity and the promotion of minorities and women in science.

**2014** Certificate of Recognition for Reviewing for the International Journal of Antimicrobial Agents. Elsevier, Amsterdam, the Netherlands.

**2015** America Society for Microbiology Distinguished service award as Editorial Board Member of the Journal of Clinical Microbiology 2006-2015

**2016** Certificate of Appreciation from the Association of Public Health Laboratories (APHL) and the America Public Health Association (APHA) for outstanding service and dedication to the “Compendium of Methods for the Examination of Foods, Fifth Edition, *Salmonella* Chapter.”

**2017** Letter of appreciation from Pamela Whitten, the Senior VP for Academic Affairs and Provost, University of Georgia. For mentoring Anh Nguyen through the Center for Undergraduate Research Opportunities (CURO). Ms. Nguyen won a 2017 CURO Fellowship for her research and presented her work at the 2017 CURO Symposium.

**REFERENCES**

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