NC1202 Annual Accomplishments Report

Project/Activity Number: NC1202
Project/Activity Title: Enteric Diseases of Food Animals: Enhanced Prevention, Control and Food Safety
Period Covered: 10/01/2023 to 09/30/2024
Date of Report: 3/12/2025
Date of Annual Meeting: 1/18/2025

Annual Meeting Participants (n = 50):

- **In-person (n = 45):** Benjamin Adu-Addai, Raghavendra Amachawadi, Babafela Awosile, Menuka Bhandari, Matthew Bradley, David Bradshaw, Yung-Fu Chang, Jordan Gebhardt, Aradhya Gourapura, Dylan Harris, Yosra Helmy, Scott Kenney, Saroj Khatiwada, Jessica Kincade, Carolyn Lee, Gizem Levent, Wenli Li, Jun Lin, George Liu, Mingde Liu, Torey Looft, Linda Mansfield, Jared Meinen-Jochum, Melha Mellata, Melissa Monson, Shafeekh Muyyarikkandy, TG Nagaraja, Xiaoyu Niu, James Okon, Gireesh Rajashekara, Sheela Ramamoorthy, Chowsa Reddy Rekalakuntavenka, Jatna Rivas Zarete, Orhan Sahin, Linda Saif, Devendra Shah, Waseem Shaukat, Milena Saqui-Salces, Elizabeth Shepherd, Smriti Shringi, Xiaolun Sun, Ning-Chieh Twu, Qiuhong Wang, Kush Kumar Yadav, Lu Yen, Ramon Alejandro Zegpi Lagos, Qijing Zhang, Glenn Zhang, Weiping Zhang
- **Remote (n = 5):** Roy Curtiss, Yuhua Farnell, Connie Gebhart, Hemant Naikare, Milena Saqui-Salces
- These investigators came from at least 27 different institutions including: Bimeda Biologicals, Cornell U, Colorado State U, Iowa State U, Kansas State U, Michigan State U, Mississippi State U, North Carolina Agricultural and Technical State U, North Dakota State U, Ohio State U, Oklahoma State U, South Dakota State U, Texas A&M, Texas Tech, Tuskegee U, U of Arkansas, U. Calgary, U of Illinois Urbana-Champaign, U of Kentucky, U of Minnesota, U of Nebraska-Lincoln, U of Tennessee, USDA ARS, USDA NIFA, U.S. Dairy Forage Research Center, USDA National Animal Disease Center, and Virginia Tech.

Brief Summary of Minutes of Annual Meeting (10:00 am - 4:00 pm on January 18, 2025):

- **Welcome:** Drs. Glenn Zhang (Chair) and Scott Kenney (Secretary)
- **Self-introductions:** Onsite and remote attendees
- **Opening remarks:** Dr. Milena Saqui-Salces, NC1202 Administrative Advisor, Remote)
- **USDA-NIFA updates:** Dr. Kathe Bjork, National Program Leader for Animal Health, provided an update on the USDA funding perspectives in person.
- **Keynote Address:** Living science: seeing, dreaming, thinking, asking, searching, joining, mentoring and remembering – every day (Dr. Roy Curtiss, University of Florida; Remote)
- **Luncheon and business meeting-**Discussed budget (Income $3,588.97 and expenses $2,225.35). Student awards; 18 presentations in 2025, 6 awards to be given. Other topics included ways to strengthen collaborations within the group and ideas for fundraising. The group would like to consider a young investigator award, increasing the number of student awards, and possibly covering some of the luncheon costs for students and postdocs for future years. The group is seeking to increase the allotted time of the meeting from CRWAD back to 8 hours allotted in 2024 instead of the 6 given this year.

- **Progress reports and presentations:** 10 speakers gave 15-minute research presentations and/or stations reports. Session ended with a 15-minute group discussion prior to adjourning.

Accomplishments

1. Established and updated an NC1202 expertise database to promote interinstitutional collaborative efforts focused on food animal enteric diseases. Link: NC1202 Expert Database
2. Awarded six graduate students for their oral or poster presentations from a total of 18 entries during the annual meeting:
    - David Francis Award (1st Place - $300): Jessica Kincade, Colorado State University.
    - David Francis Award (2nd Place - $200): Bibek Lamichhane, University of Kentucky.
    - David Francis Award (3rd Place - $150): Maria Hakimi, Iowa State University.
    - Lynn Joens Memorial Award (1st Place - $300): Jodie Allen, Univ. of Connecticut.
    - Lynn Joens Memorial Award (2nd Place - $200): Valeria Lugo-Mesa, TAMU.
    - Lynn Joens Memorial Award (3rd Place - $150): Maya Craig, Cornell University.
3. Contributed to swine gastrointestinal health by characterizing *Lawsonia intracellularis* focusing on interactions with the host including showing a preference for infection of fibroblastic cell types over goblet or epithelial cells, Wnt signaling.
4. Trained students, stakeholders, and government entities including biosecurity audits for *Campylobacter hepaticus* in poultry farms and educated 21 North Carolina State officials on egg and poultry industry practices while conducting biosecurity audits.
5. Developed novel antibiotic alternatives and vaccines for poultry targeting *Salmonella, Eimeria,* and necrotic enteritis.
6. Created novel vaccines and vaccine technology for pigs targeting porcine epidemic diarrhea virus (PEDV) and porcine reproductive and respiratory syndrome virus (PRRS).
7. Established novel and improved research models including avian intestinal organoid models for the study of host-pathogen interaction and broiler chicken bacterial lameness models.
8. Revealed that dietary supplementation of encapsulated bile salt hydrolase (BSH) inhibitor enhanced broiler growth performance as a promising non-antibiotic growth promoter for mitigation of antibiotic resistance and sustainable poultry production.
9. Surveyed *Enterococcus cecorum* pathogenicity factors in field isolates, characterized the immune response of turkeys to *Histomonas meleagridis* infection, and assessed the contribution of flagellar components of *C. difficile* mutants to mucoadhesion and genes such as pilA1 to pili formation,
10. Studied antibiotic resistance under fluoroquinolone (FQ)-treatment during *Campylobacter jejuni* infections
11. Novel tests were developed to detect *Fusobacterium necrophorum* subsp. *necrophorum, F. necrophorum* subsp. *funduliforme, Trueperella pyogenes,* and *Salmonella enterica* to assess their role in cattle liver abscesses.
12. Isolated and characterized emerging gastroenteric infections in pigs including porcine sapovirus (PoSaV) strains and emerging Rocahepevirus ratti (hepatitis E virus) strains.

Impacts:

1. An updated expertise database enables NC1202 members to more readily identify potentially synergistic or unique experts to facilitate more productive group research efforts. Members

of NC1202 and the greater research community can now more easily identify specific researchers and their expertise within the group.
2. Projects contributed to the training of > 20 graduate and undergraduate students in a range of techniques critical to maintaining and improving animal health and food productivity.
3. Multiple projects directly interacted with stakeholders and government entities to enhance public knowledge of their respective industries and biosecurity protocols necessary to mitigate disease introduction and spread.
4. Projects identified and characterized emerging or circulating pathogens and their potential contributions to animal health. For example, *C. hepaticus* was identified in a majority of field samples in poultry with spotty liver disease implicating it as a disease causative agent. *E. cecorum* pathogenicity factors were identified allowing for better identification of potential poultry disease causing pathogens. Circulating porcine sapoviruses were identified allowing for development of potential vaccines to combat porcine diarrhea, and emerging viruses such as rat hepatitis E virus were shown to infect pigs but not pose a direct health threat.
5. Identification of the microbiome signature in calves contributes to diarrhea allowing researchers to understand and treat diarrhea with the host's microbiome.
6. Creation of novel non-antibiotic feeding technologies and vaccine technologies such as subunit vaccines against *Salmonella*, live attenuated vaccines for PEDV, and PRRSV reduces economic losses, while allowing producers to provide safer food products to the consumer.

Grants and Contracts Received between 10/01/2023 and 09/30/2024 (Only federal grants listed; Names in bold denote the NC1202 participants; 10 grants totaling $12,380,627)

1. **Fan P**, Lemley C, Vann R, Burnett D. Understanding the Rumen-Microbiota-Brain Axis of Lactating Dairy Cows under Heat Stress. USDA-NIFA. 06/2024-06/2026. $300,000.
2. Zhang L (PI), **Fan P,** Zhang X, Macklin K, Arick M. Integrating Genomics, Epidemiology, and On-site Diagnostics for Poultry and Bovine Respiratory Bacterial Diseases Management. USDA-ARS NACA. 10/2024-10/2025. $300,000.
3. **Farnell YF** (PI). Establishment and Characterization of Liver Organoids from Layer Chickens. USDA-ARS. $112,611.
4. **Farnell, MB** (PI). Microbial Evaluation of Poultry Farm Pathogen Interventions to Improve Biosecurity - USDA-NADPRP - $116,808.
5. **Farnell MB** (Co-PI). 2023. Evaluation and Identification of Psycho-Socio-Demographic Factors Impacting the Implementation of and Compliance to Biosecurity Plans for Relevant Infectious Diseases in Poultry Farmers in Texas. USDA-NADPRP. $306,042.
6. **Farnell MB** (Co-PI). Thermal Dehydration for Mass Disposal of Poultry Mortalities and Poultry Products. USDA-APHIS-V.S. $171,189.
7. **Farnell MB** (Co-PI). Poultry Agribusiness Training for Development of an Enhanced Emergency Preparedness Infrastructure Partnership between the US Commercial Poultry Industry and Animal Health Officials. USDA-MIS-APHIS. $168,166.
8. **Sang Y** (PI). Whole-transcriptomic Profiling of Non-Coding RNAs for Antiviral Regulation in Porcine Alveolar Macrophages. NIFA-USDA TENX-2322-GFSHAP. 11/03/2023-09/30/2026. $123,000.
9. **Zhang G** (PI). Microbiome-Mediated Colonization Resistance against Necrotic Enteritis. USDA–NIFA. Award no. 2024-67016-42415. 07/01/2024 – 06/30/2027. $650,000.

10. Kim Y (PI), **Zhang G** (co-PI). Tea L-Theanine Protects Nonalcoholic Fatty Acid Disease (NAFLD) via the Gut-Liver Axis. USDA–NIFA. Award no. 2024-67018-42461. 06/01/2024 – 05/31/2026. $300,000.
11. **Zhang W**, Silvera P, Sack DA. Development of MecVax, a cross-protective subunit vaccine for ETEC. NIH R01AI177144-01. 6/1/2023 – 5/30/2028. $5,643,881
12. Sack DA, Z**hang W**. A cross-protective multivalent vaccine for Shigella and ETEC. 3/6/2023 – 2/29/2028. NIH R01AI175214-01. $3,921,648
13. **Gebhardt, JT**, Woodworth, JC, Paulk, CB, Jones, CK. USDA/NIFA. Capacity Grant: Addressing animal health through animal feed for prevention and control of animal disease. 10/1/1023-9/30/2025. $70,000.
14. **Nagaraja, T. G**. and **Raghavendra Amachawadi**. Metabolomic analysis of blood plasma to identify unique biomarkers indicative of liver abscesses. Foundation for Food and Agriculture Research 2023-2025. $497,282.

Publications between 10/01/2023 and 09/30/2024 (Names in bold denote the NC1202 participants).

1. Liao, SF, Ji, F, **Fan, P**, Denryter K. 2024. Swine Gastrointestinal Microbiota and the Effects of Dietary Amino Acids on Its Composition and Metabolism. Int. J. Mol. Sci. 25(2):1237.
2. Zhai Y, Kim M, **Fan P**, Rajeev S, Kim SA, Driver JD, Galvão KN, Boucher C, Jeong KC. 2024. Machine learning-enhanced assessment of potential probiotics from healthy calves for the treatment of neonatal calf diarrhea. Front. Microbiol. 15, 1507537.
3. Liu T, Lee S, Kim M, **Fan P**, Boughton RK, Boucher C, Jeong KC. 2024. A study at the wildlife-livestock interface unveils the potential of feral swine as a reservoir for extended-spectrum β-lactamase-producing Escherichia coli. J. Hazard. Mat. 473:134694.
4. Skrobarczyk JW, Caldwell DJ, McKenzie KS, Blankenburg AC, Byrd JA, **Farnell MB**. 2024. Evaluation of a Compressed Air Foam System to Clean Quail Rearing Facilities. J. Appl. Poult. Res. 34(1): 100458.
5. Milby-Blackledge A, **Farnell YZ**, Zhao D, Berghman L, Laino C, Muller M, Byrd JA, **Farnell M**. 2024. Serum cytokine profile of neonatal broiler chickens infected with *Salmonella* Typhimurium. Front Physiol. 15:1359722.
6. Noh JY, Han HW, Kim DM, Giles ED, **Farnell YZ**, Wright GA, Sun Y. 2024. Innate immunity in peripheral tissues is differentially impaired under normal and endotoxic conditions in aging. Front. Immunol. 15:1357444.
7. Alenezi T, Fu Y, Alrubaye B, Alanazi T, Almansour A, Wang H, **Sun X**. 2024. Recombinant Bile Salt Hydrolase Enhances the Inhibition Efficiency of Taurodeoxycholic Acid against *Clostridium perfringens* Virulence. Pathogens. 13(6):464.
8. Majeed, S., S. K. Hamad, B. R. Shah, L. Bielke, and **A. Nazmi**. 2024. Natural intraepithelial lymphocyte populations rise during necrotic enteritis in chickens. Front. Immunol. 15: 1354701.
9. Majeed, S., B. R. Shah, N. Khalid, L. Bielke, and **A. Nazmi**. 2024. Dynamic Changes in the Intraepithelial Lymphocyte Numbers Following *Salmonella* Typhimurium Infection in Broiler Chickens. Animals 14:3463.
10. **Nazmi, A**., S. Majeed, S. Hamad, B. Shah, and L. Bielke. 2024. Natural intraepithelial lymphocytes are critical intestinal defense against necrotic enteritis in chickens. J. Immunol. 212:1577-5219.

11. Ronish LA, **Biswas B**, Bauer RM, Jacob ME, Piepenbrink KH. 2024. The role of extracellular structures in Clostridioides difficile biofilm formation. Anaerobe. 88:102873.
12. Ott L, Smith C, **Mellata M**. 2024. Dietary zinc supplementation inhibits bacterial plasmid conjugation in vitro by regulating plasmid replication (*rep*) and transfer (*tra*) genes. Appl. Environ. Microbiol. 90: e01480-24.
13. Ott L., **Mellata M**. 2024. Short-chain fatty acids inhibit bacterial plasmid transfer through conjugation *in vitro* and in *ex vivo* chicken tissue explants. Front. Microbiol. 15: 1414401.
14. Li, Y., Palomares, R.A., Liu, M., Xu, J., Koo, C., Granberry, F., Locke, S.R., Habing, G., **Saif, L.J.**, Wang, L., **Wang, Q.** 2024, Isolation and Characterization of Contemporary Bovine Coronavirus Strains. Viruses 16:965.
15. Amimo JO, Michael H, Chepngeno J, Jung K, Raev SA, Paim FC, Lee MV, Damtie D, **Vlasova AN** and **Saif LJ.** 2024. Maternal immunization and vitamin A sufficiency impact sow primary adaptive immunity and passive protection to nursing piglets against porcine epidemic diarrhea virus infection. Front. Immunol. 15:1397118.
16. Raev, S.A.; Kick, M.K.; Chellis, M.; Amimo, J.O.; **Saif, L.J.; Vlasova, A.N**. 2024. Histo-Blood Group Antigen-Producing Bacterial Cocktail Reduces Rotavirus A, B, and C Infection and Disease in Gnotobiotic Piglets. Viruses 16: 660.
17. **Yadav KK**, Boley PA, Khatiwada S, Lee CM, Bhandari M, Wood R, Hanson J, **Kenney SP**. 2024. The zoonotic LCK-3110 strain of Rocahepevirus ratti leads to mild infection in chickens after experimental inoculation. Virus Res. 350:199477.
18. **Yadav KK**, Boley PA, Lee CM, Khatiwada S, Jung K, Laocharoensuk T, Hofstetter J, Wood R, Hanson J, **Kenney SP**. 2024. Rat hepatitis E virus cross-species infection and transmission in pigs. PNAS Nexus. 3(7):259.
19. Kandel, A., L. Li, Y. Wang, W. Tuo, and **Z. Xiao**. 2024. Differentiation and Regulation of Bovine Th2 Cells In Vitro. Cells 13 (9): 738.
20. Grayfer L, Edholm ES, Chinchar VG, **Sang Y**, Robert J. 2024. Immune defenses against ranavirus infections. In: Gray, M.J., Chinchar, V.G. (eds) Ranaviruses. Springer, Cham. https://doi.org/10.1007/978-3-031-64973-8_4. pp. 83-119.
21. Davila KMS, Fleming DS, Lager KM, Li J, **Sang Y**. 2024. Transcriptome Analysis in Air–Liquid Interface Porcine Respiratory Epithelial Cell Cultures Reveals That the Betacoronavirus Porcine Encephalomyelitis Hemagglutinating Virus. Viruses 16 (6): 939.
22. Li J, Miller LC, **Sang Y**. 2024. Current Status of Vaccines for Porcine Reproductive and Respiratory Syndrome: Interferon Response, Immunological Overview, and Future Prospects. Vaccines 12 (6): 606.
23. Davila KMS, Nelli RK, Phadke KS, Ruden RM, **Sang Y**, Bellaire BH, Gimenez-Lirola LG, Miller LC. 2024. How do deer respiratory epithelial cells weather the initial storm of SARS-CoV-2 WA1/2020 strain? Microbiol. Spectr. 12 (2): e02524-23
24. Poudel S, Zeng X, **Lin J**, Cheng WH, Sukumaran AT, Adhikari P, Kiess AS, Macklin KS, Zhang L. 2024. Recent advances and challenges in developing vaccines for *Campylobacter jejuni*: a comprehensive review. *J. World's Poult. Sci.* 80 (3): 767-790.
25. Boorman J, Zeng X, **Lin J**, van den Akker F. 2024. Structural insights into peptidoglycan glycosidase EtgA binding to the inner rod protein EscI of the type III secretion system. *Prot. Sci*. 33(3):e4930.

26. Gong J, Zeng X, Xu J, Zhang D, Dou X, **Lin J**, Wang C. 2024. Genomic characterization of a plasmid-free and highly drug-resistant *Salmonella enterica* serovar Indiana isolate in China. *Vet. Sci.* 11(1): 46

27. Zeng X., Vidlund J, Gillespie B, Cao L, Agga G, **Lin J**, Kerro Dego O. 2023. Evaluation of immunogenicity of enterobactin conjugate vaccine for the control of *E. coli* mastitis in dairy cows. *J. Dairy Sci.* 106(10): 7147-7163.

28. Whitmore M, Tobin I, Burkardt A, **Zhang G**. 2024. Nutritional modulation of host defense peptide synthesis: a novel host-directed antimicrobial therapeutic strategy? Adv. Nutr. 15: 100277.

29. Kim DM, Liu J, Whitmore MA, Tobin I, Zhao Z, **Zhang G**. 2024. Two intestinal microbiota-derived metabolites, deoxycholic acid and butyrate, synergize to enhance host defense peptide synthesis and alleviate necrotic enteritis. J. Anim. Sci. Biotech. 15: 29.

30. Liu J, Guo J, Whitmore MA, Tobin I, Kim DM, Zhao Z, **Zhang G**. 2024. Dynamic response of the intestinal microbiome to *Eimeria maxima*-induced coccidiosis in chickens. Microbiol. Spectr. 12: e00823-24.

31. Wu Y, Zhang X, Liu X, Zhao Z, Tao S, Xu Q, Zhao J, Dai Z, **Zhang G**, Han D, Wang J. 2024. Galactooligosaccharides and *Limosilactobacillus reuteri* synergistically alleviate intestinal inflammation and barrier dysfunction by enriching *Bacteroides acidifaciens* for pentadecanoic acid biosynthesis. Nat. Commun. 15: 9291.

32. Wang G, Fan Y, **Zhang G**, Cai S, Ma Y, Yang L, Wang, Y, Yu H, Qiao S, Zeng X. Microbiota-derived indoles alleviate intestinal inflammation and modulate microbiome by microbial cross-feeding. Microbiome 2024, 12: 59.

33. Wu Y, Zhang X, Liu X, Li Y, Han D, Pi Y, Whitmore MA, Lu X, **Zhang G**, Zheng J, and Wang J. 2024. Strain specificity of lactobacilli with promoted colonization by galacto-oligosaccharides administration in protecting intestinal barrier during *Salmonella* infection. J. Adv. Res. 56: 1-14.

34. Ma L, Lyu W, Zeng T, Wang W, Chen Q, Zhao J, **Zhang G**, Lu L, Yang H, Xiao Y. 2024. Duck gut metagenome reveals the microbiome signatures linked to intestinal regional, temporal development, and rearing condition. iMeta 3(3): e198.

35. Lamichhane G, Liu J, Lee SJ, Lee DY, **Zhang G**, Kim Y. 2024. Curcumin mitigates high-fat high-sugar diet induced impairment of spatial memory, metabolic function and alteration of gut microbiome in Alzheimer's disease-induced (3xTg-AD) mice. Nutrients 16(2): 240.

36. Lamichhane G, Olawale F, Liu J, Lee D-Y, Lee S-J, Chaffin N, Alake SE, Lucas EA, **Zhang G**, Egan JM, Kim Y. 2024. Curcumin mitigates gut dysbiosis and enhances gut barrier function to alleviate metabolic dysfunction in diet-induced obesity and aging. Biology 13(12): 955.

37. Su CM, Kim J, Tang J, Hung YF, Zuckermann F, Husmann R, Roady P**,** Kim J, Lee YM, **Yoo D.** 2024. A clinically attenuated double-mutant of porcine reproductive and respiratory syndrome virus-2 that does not prompt overexpression of proinflammatory cytokines during co-infection with a secondary pathogen. PLOS Pathogens 20(3): e1012128.

38. Su CM, Hung YF, Tang J, Han M**,** Everett R, **Yoo D.** 2023. Suppression of TRIM19 by arterivirus nonstructural protein 1 promotes viral replication. Virus Research 340:199302.

39. Zhang CY, S Li, I Upadhyay, KL Lauder, DA Sack, **W Zhang***. 2024. MecVax supplemented with CFA MEFA-II induces functional antibodies against twelve adhesins (CFA/I, CS1-Cs7, Cs12, CS14, CS17, CS21) and two toxins (STa, LT) of enterotoxigenic Escherichia coli (ETEC). Microbiol Spect 12(4):e0145323.

40. Li S, **W Zhang***. 2024 Mapping the functional B-cell epitopes of Shigella invasion plasmid antigen D (IpaD). Appl Environ Microbiol 90(8): e0098824.

41. Upadhyay I, SM Parvej, Y. Shen, S Li, KL Lauder, C. Zhang, **W. Zhang***. 2023. Protein-based vaccine candidate MecVax broadly protects against intestinal colonization of ETEC strains expressing different adhesins (CS1 – CS6) in a rabbit model. Infect Immun 91(11):e0027223.

42. Li S, S Anvari, G Ptacek, I Upadhyay, RW Kaminski, DA Sack, **W Zhang***. 2023. A broadly immunogenic polyvalent Shigella multiepitope fusion antigen (MEFA) protein protects against S. sonnei and S. flexneri lethal pulmonary challenges in mice. Infect Immun 91(11):e0031623.

43. Deblais L, Kauffman M, **Rajashekara G**. Impact of Irrigation Source on the Dissemination and Persistence of Coliforms and Foodborne Pathogens in Fresh Tomato High Tunnel-dripline System from Small Specialty Crop Farms. J Food Prot. 2024 Dec;87(12):100382. doi: 10.1016/j.jfp.2024.100382. Epub 2024 Oct 17. PMID: 39424102.
44. Hailu W, Alemayehu H, Wolde D, Hailu L, Medhin G, **Rajashekara G**, Gebreyes WA, Eguale T. Prevalence and antimicrobial susceptibility profile of Salmonella isolated from vegetable farms fertilized with animal manure in Addis Ababa Ethiopia. Sci Rep. 2024 Aug 19;14(1):19169. doi: 10.1038/s41598-024-70173-4. PMID: 39160213; PMCID: PMC11333614.
45. Hailu W, Alemayehu H, Hailu L, Medhin G, **Rajashekara G**, Gebreyes WA, Eguale T. Escherichia coli isolates from vegetable farms in Addis Ababa, Ethiopia: Antimicrobial susceptibility profile and associated resistance genetic markers. Food Sci Nutr. 2024 Mar 10;12(6):4122-4132. doi: 10.1002/fsn3.4071. PMID: 38873492; PMCID: PMC11167155.
46. Deblais L, Drozd M, Kumar A, Antwi J, Fuchs J, Khupse R, **Helmy YA, Rajashekara G.** Identification of novel small molecule inhibitors of twin arginine translocation (Tat) pathway and their effect on the control of Campylobacter jejuni in chickens. Front Microbiol. 2024 Apr 17;15:1342573. doi: 10.3389/fmicb.2024.1342573. PMID: 38694802; PMCID: PMC11061419.
47. Shrestha R, Thenissery A, Khupse R, **Rajashekara G**. Strategies for the Preparation of Chitosan Derivatives for Antimicrobial, Drug Delivery, and Agricultural Applications: A Review. Molecules. 2023 Nov 18;28(22):7659. doi: 10.3390/molecules28227659. PMID: 38005381; PMCID: PMC10674490.
48. **Bhandari M**, Poelstra JW, Kauffman M, Varghese B, **Helmy YA, Scaria J, Rajashekara G.** Genomic Diversity, Antimicrobial Resistance, Plasmidome, and Virulence Profiles of Salmonella Isolated from Small Specialty Crop Farms Revealed by Whole-Genome Sequencing. Antibiotics (Basel). 2023 Nov 18;12(11):1637. doi: 10.3390/antibiotics12111637. PMID: 37998839; PMCID: PMC10668983.
49. Kabir A., Kelley WG., Glover C., Erol E., and **Helmy Y.A.*** (2025). Phenotypic and genotypic characterization of antimicrobial resistance and virulence profiles of Salmonella

enterica serotypes isolated from necropsied horses in Kentucky. Microbiology Spectrum e02501-24.
50. Closs, Jr G, **Bhandari M**, **Helmy Y.A**., Kathayat D, Lokesh D, Jung K, Suazo I, Srivastava V, Deblais L, **Rajashekara G**. (2025). Lacticaseibacillus rhamnosus GG (LGG) reduces Salmonella colonization in chickens. Immunity& infections. In press.
51. **Helmy Y.A**.*, Kabir A, Salah M, Kennedy LA, Burns L, and Johnson B (2024). Draft Genome Sequence Analysis of Multidrug-Resistant Salmonella enterica subsp. enterica serovar Mbandaka Harboring Colistin Resistance Gene mcr-9.1 Isolated from Foals in Kentucky, USA. Microbiology Resource Announcements 7:e0073724.
52. Rahman MM*, Hossain H, Chowdhury MSR, Hossain MM, Saleh A, Binsuwaidan R, Noreddin A, **Helmy Y.A**.*, El Zowalaty ME* (2024). Molecular Characterization of Multidrug-Resistance and Extended-Spectrum β-Lactamases-Producing Salmonella enterica serovars Enteritidis and Typhimurium isolated from Raw Meat in Retail Markets.
53. Deblais L, Drozd M, Kumar A, Antwi J, Fuchs J, Khupse R, **Helmy Y.A**., and **Rajashekara G** (2024). Identification of novel small molecule inhibitors of twin-arginine translocation (Tat) pathway and their effect on the control of Campylobacter jejuni in chickens. Frontiers in Microbiology 15:1342573.
54. Abouelela ME., and **Helmy Y.A.***. (2024). Next-Generation Probiotics as Novel Therapeutics for Improving Human Health: Current Trends and Future Perspectives. Microorganisms 12(3), 430.
55. Lamichhane B, Mawad AMM., Saleh M., Kelley WG, Harrington PJ, Lovestad CW, Amezcua J, Sarhan MM, El Zowalaty ME, Ramadan H, Morgan M, **Helmy Y.A***. (2024). Salmonellosis: An Overview of Epidemiology, Pathogenesis, and Innovative Approaches to Mitigate Antimicrobial Resistant Infections. Antibiotics 13 (1): 76.
56. Magossi, G., K. E. Gzyl, D. B. Holman, **T. G. Nagaraja**, R. G. Amachawadi, and S. Amat.
57. Deters, A., X. Shi, J. Bai, Q. Kang, J. Mathieu, and T. G. Nagaraja. 2024. A real-time PCR assay for the detection and quantification of *Fusobacterium necrophorum* and *F. varium* in ruminal contents of cattle. *Applied Animal Science,* 40:250-259. https://doi.org/10.15232/aas.2023-02507
58. Deters, A., X. Shi, T. Lawrence, and **T. G. Nagaraja**. 2024. First report of isolation of *Fusobacterium varium* from liver abscesses and ruminal and colonic epithelial tissues of feedlot cattle. *Applied Animal Science,* 40:244-249. https://doi.org/10.15232/aas.2023-02512
59. McDaniel, Z. S., K. E. Hales, H. Salih, A. Deters, X. Shi, **T. G. Nagaraja**, T. E. Lawrence, R. G. Amachawadi, J. A. Carroll, N. C. Burdick Sanchez, M. L. Galyean, T. M. Smock, M. A. Ballou, V. S. Machado, E. Davis, and P. R. Broadway. 2024. Development of an experimental model to induce liver abscesses in steers using an acidotic diet challenge and intraruminal bacterial inoculation. *Journal of Animal Science*. 102:ska046. https://doi.org/10.1093/jas/skae046
60. McDaniel, Z. S., K. E. Hales, **T. G. Nagaraja**, T. E. Lawrence, T. C. Tennant, R. G. Amachawadi, J. A. Carroll, N. C. Burdick Sanchez, M. L. Galyean, E. Davis, K. Kohl, D. J. Line, C. W. Dornbach, M. Abbasi, H. Salih, A. Deters, X. Shi, M. A. Ballou, V. S. Machado, T. M. Smock and P. R. Broadway. 2024.Validation of an experimental model to induce liver abscesses in Holstein steers using an acidotic diet challenge and intraruminal bacterial inoculation. *Applied Animal Science*. 40:398-413. https://doi.org/10.15232/aas.2023-02485

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