Project Title: Investigation of methods for surveillance of methicillin-resistant Staphylococcus species in the ISU LVMC

Principle Investigator(s): Amanda Kreuder, Orhan Sahin

Collaborating Investigator(s):

Veterinary Scholar Focused Abstract: (300 words or less):

Methicillin-resistant Staphylococcus aureus (MRSA) and S. pseudintermedius (MRSP) are important pathogens of veterinary patients, and both have the potential to cause zoonotic disease. A recent increase has been noted in the number of suspected nosocomial infections within the ISU LVMC related to these organisms (MRSP in particular), however, no surveillance program currently exists to both investigate the potential for environmental contamination nor determine if nosocomial infections are occurring. In additional, while surveillance programs for MRSA in human hospitals are well established, little has been published on surveillance of MRSP in the veterinary setting.

The goals of this summer research project will be: 1) determine the optimal selective bacteriologic medium for identification of MRSA and MRSP from environmental samples in a veterinary hospital, 2) perform weekly surveillance of both the small and large animal hospitals for MRSA/MRSP contamination, 3) further characterize identified isolates based on antibiotic susceptibility patterns, MALDI-TOF, MLST typing, and/or PCR methodology to determine isolate similarity, and 4) assist in development of a practical surveillance plan for the LVMC for these pathogens in the future.

The results of this project will provide valuable information for veterinary hospitals in developing appropriate surveillance strategies to combat the nosocomial spread of antibiotic resistant Staphylococcus species.
C2 – Dr. Millman

Project Title:
Does Social Buffering Enhance Animal Welfare And Performance When Beef Calves Are Commingled In Feedyard Environments?

Principal Investigator(s):
Dr. Suzanne Millman

Collaborating Investigator(s):
Drs. Grant Dewell, Anna Johnson, Renee Dewell

Veterinary Scholar Focused Abstract: (300 words or less):
This summer scholar position will contribute to aspects of our USDA-funded project, developed in collaboration with a commercial beef feedyard, with the goals of enhancing sustainability and minimizing ecological footprint in beef production. Commingling of calves from different sources presents biological and behavioral stressors, and is associated with increased risk for Bovine Respiratory Disease. Social buffering refers to the phenomenon of enhanced recovery from distress in the presence of a conspecific, with known neuroendocrine mechanism. In this proposal we explore whether preferential relationships among beef feeder cattle produces social buffering, with positive animal welfare, health and performance outcomes. In Objective 1, we will examine social dynamics of pasture-reared beef calves associated with weaning and changes in health status. Preferential relationships among calves will be identified using social network analysis. In Objective 2, detailed behavior and endocrine observations will be used to explore effects of familiarity on preferential relationships in small pens of commingled beef bulls. Calf responses to common stressors (commingling, routine processing and castration) will be compared to determine significance of social buffering on calf stress and pain responses. In Objective 3, impacts of social buffering on behavior, health and performance of comingled lightweight cattle on a commercial feedlot will be determined. Familiar calves, sourced as groups from the same farm, and Solitary calves sourced singly from farms, will be followed through the feeding period, and health, performance and behavior outcomes compared to evaluate effects of social buffering in commercial conditions. Results from this project will provide needed guidance on commingling practices in U.S. beef operations.
Project Title: *Clostridium difficile infection*: pathogenesis, epidemiology and novel control strategies

Principal Investigator(s): Shankumar Mooyottu, DVM, PhD, DACVP

Collaborating Investigator(s):

Veterinary Scholar Focused Abstract: (300 words or less):
Clostridium difficile (CD) is a spore-forming, strictly anaerobic bacterium that causes a toxin-mediated enteric disease in humans and animals. CD infection has been associated with the use of antibiotics that results in disruption in normal enteric microflora (gut-dysbiosis), subsequent pathogen colonization and severe toxin-mediated colitis. Despite the fact that a majority of the currently used antibiotics can predispose CD infection by disrupting the normal gut flora, antibiotics are still used as the primary line of treatment against infection. Moreover, the Centers for Disease Control and Prevention recently listed CD as one among the three urgent threats in their report on emerging pathogens with antibiotic resistance. Since the toxins are the major virulence factors for CD infection, a search for an alternative, non-antibiotic therapeutic agents, which can reduce CD virulence without causing gut-dysbiosis opens a new research area.

My research focuses on the mechanism of CD pathogenesis and non-antibiotic strategies for preventing gut-dysbiosis and CD virulence. My research project involves screening and testing various small molecules and specific probiotic bacteria for their effects on CD toxin production, cytotoxicity, toxin gene expression, sporulation and spore germination using anaerobic bacteriologic and molecular techniques. We are currently testing such anti-CD strategies in a novel swine surgical *in situ* ileal loop model. Additionally, we investigate potential zoonotic transmission of CD and genetic and evolutionary relationship between human and animal (more importantly pets) isolates of CD. The results from this research could help the medical and scientific community to develop and validate new strategies to control CD infection in humans and animals.
Project Title: Antimicrobial resistance in enteric bacteria from retail meat at Iowa grocery stores

Principal Investigator(s): Orhan Sahin

Collaborating Investigator(s): Qijing Zhang

Veterinary Scholar Focused Abstract: (300 words or less):

Antimicrobial resistance (AMR) is a major health threat affecting the well-being of humans, animals, and the environment worldwide. Robust and comprehensive surveillance systems emphasizing the “One Health” approach are necessary for effectively combatting AMR. In the United States, surveillance of AMR in select enteric bacteria (non-typhoidal *Salmonella*, *Campylobacter*, *Enterococcus* and *Escherichia coli*) from retail raw meat (chicken, ground turkey and beef, and pork chop) is performed routinely at the federal and state levels. These programs have contributed significantly to monitoring the sources and trends of AMR in the food chain. To enhance the effort on combating AMR, our laboratory at ISU has established a partnership with the national surveillance programs and become a network laboratory for AMR surveillance in Iowa. This inclusion as a new site has substantially increased and strengthened the capacity and effectiveness of the national surveillance program in retail food. We obtain and process raw meat samples (chicken, pork chop, ground beef, and ground turkey) from grocery stores in Iowa and culture them for isolation of *Salmonella*, *Campylobacter*, *E. coli* and *Enterococcus*. Furthermore, antimicrobial susceptibility testing (AST) using a microbroth dilution method with Sensititre commercial plates is performed to determine the AMR profiles of the isolates. Finally, PCR and sequencing based molecular approaches are utilized to ascertain the genetic mechanisms for AMR. This collaborative work significantly contributes to mitigation of AMR in the food chain and thus will improve food safety and public health.