MICROBIOLOGY & IMMUNOLOGY SEMINAR

Dr. Keun Seok Seo

Associate Professor
Department of Comparative Biomedical Sciences
College of Veterinary Medicine
Mississippi State University

“Metabolic adaptation of Staphylococcus aureus in diabetes”

Monday, October 25th, 2021
3:30 P.M., Microsoft Teams

All UMMC faculty, staff and students are invited.
Short Autobiography:

I am an Associate Professor at the Department of Comparative Biomedical Sciences, College of Veterinary Medicine, Mississippi State University. My main research areas are understanding molecular mechanisms of bacterial pathogenesis and development of alternative therapeutics. To achieve these goals, I have developed several molecular biology techniques and antibody tools to understand the function of virulence factors, receptors in the hosts, and immune response to infections in humans and various animal models. *Staphylococcus aureus* is one of the toughest pathogens for genetic manipulation due to its poor transformability. In collaboration with Dr. Joo Youn Park, we have developed molecular biology tools to generate highly efficient competent cells of *S. aureus* and a markerless homologous recombination plasmid vector in which the loss of GFP-uv signal can be used as a selection marker for homologous recombination. Using these tools, Dr. Park and I have characterized the Hexose Phosphate Transport system in *S. aureus*, developed genetically engineered CRISPR-Cas9 phage therapy, and demonstrated horizontal gene transfer of entire pathogenicity islands by temperate phages. Recently, Dr. Park and I investigated the effect of sugar metabolism on the pathogenesis of *S. aureus*. We found that metabolism of glucose, historically known to increase virulence of *S. aureus*, did not induce strong virulence, compared to metabolism of other sugars elevated in diabetic patients. These results inspired us to investigate the effect of sugar metabolism on *S. aureus* virulence. We demonstrated that metabolism of glucose-6-phosphate highly increased the virulence of *S. aureus* by inducing expression of staphylococcal exotoxins, decreasing sensitivity to vancomycin, and promoting biofilm formation. Our preliminary RNA-seq revealed that G6P diverted the metabolic flow to nitrate respiration under aerobic conditions which would be diverted to anaerobic fermentation under hypoxic conditions that increase biofilm formation and exotoxin productions. Dr. Park and I tested several diabetic animal models and found that TALLYHO JnJ mice is an excellent animal model for human type 2 diabetes because it spontaneously developed hyperglycemia, insulin tolerance due to the polygenetic background which is highly similar to human type 2 diabetes. We demonstrated that *S. aureus* infection in diabetic TALLYHO JnJ mice caused significantly more severe tissue necrosis and bacterial burden than in non-diabetic SWR/J mice.