SPOTLIGHT ON
Long Island University Veterinary Medicine
Advancing animal health and welfare through research

Research diversity in infectious and immunological diseases at Long Island University College of Veterinary Medicine

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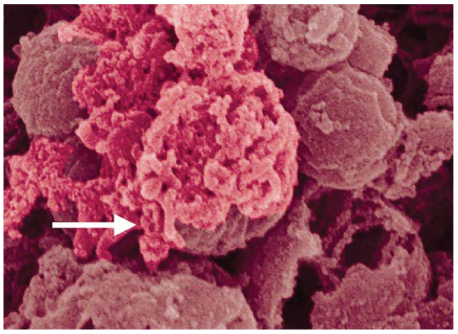
The Long Island University College of Veterinary Medicine (LIU CVM) is a relatively new school that graduated its first class of DVM students in May 2024. Master of Science and PhD graduate programs in Comparative Biomedical and Veterinary Sciences have also been established. The LIU CVM faculty have already been highly successful in obtaining competitive research funding from the USDA-NIFA, the NIH, the NSF, industry, and independent nonprofit organizations. One research focus of the college is One Health, with emphasis on infectious and immunological diseases.

Bovine respiratory disease (BRD) is the most economically important disease affecting the bovine industry. Dr. Tom Inzana, Dr. Dianjun Cao, and collaborators are investigating how biofilm formation by the bacterial pathogens *Histophilus somni*, *Pasteurella multocida*, and *Mannheimia haemolytica* contributes to and affects the treatment of BRD. Three-dimensional bovine respiratory organoids are used to study biofilms in situ, and compounds have been identified that can remove established bacterial biofilms, and may enhance the efficacy of antibiotics against biofilm bacteria. To promote the prevention of BRD, bacterial surface antigens required for virulence that are expressed in the host, but not in vitro, are being identified to develop a more efficacious vaccine.

Bovine metritis is an important disease caused by dysbiosis of the uterine microbiota and overgrowth of opportunistic pathogens, such as *Fusobacterium necrophorum*, *Bacteroides pyogenes*, and *Porphyromonas levii*. Dr. Soo Jin Jeon and Dr. Cao are investigating the molecular and metabolic mechanisms by which these bacteria promote virulence, growth, collonization, and inflammation in the host. They employ 3-D cultures of bovine endometrial epithelial cells, biofilm formation assays, and the identification of key bacterial metabolites to further understand host-pathogen interactions.

Drs. Jeon and Cao are also investigating the mechanisms underlying ESD in the American lobster (*Homarus americanus*). Epizootic shell disease is characterized by carapace erosion, pitting, and melanization. Using high-throughput 16S rRNA sequencing, they are identifying specific carapace microbiota associated with ESD, such as *Aquimarina*, *Halocynthiibacter*, and *Tenacibaculum* spp. How these bacteria invade internal organs is also being examined. RNA sequencing is being used to analyze the transcriptome of ESD-affected tissues in diseased lobsters compared to healthy lobsters, and identify genes and pathways involved in ESD development.

Bovine mastitis causes significant economic losses leading to death or early culling of affected cows and is most often caused by *Mycoplasma bovis* and/or *Staphylococcus aureus*. Dr. Yasser Mahmmod is validating novel methods for identification of mastitis pathogens and developing a chimeric vaccine using immunoinformatics and machine learning to target antibiotic-resistant pathogens in dairy cows.



Histophilus somni biofilm in the respiratory tract of a calf with bovine respiratory disease. The biofilm matrix (arrows) is covering the coccobacilli cells in the respiratory epithelium.

Zoonotic bacteria and antimicrobial resistance affects animal and public health. Dr. Reta Abdi is investigating the role of zoonotic bacterial products and their membrane proteins on antimicrobial resistance mechanisms, virulence, and host-pathogen interactions in food animals and pets to develop alternative therapies to antibiotics. Dr. Abdi is examining how colonization by antibiotic-resistant bacteria alters the functional diversity of host bacterial communities.

In the field of molecular virology, Dr. Maged Hemida's research focus is on coronaviruses and virus-host interactions from a One Health perspective. His research involves the study of microRNAs in the pathogenesis of bovine coronavirus (BCoV). Several host cell microRNAs have been identified that may fine-tune BCoV replication and tissue tropism. Students in Dr. Hemida's laboratory are involved in the isolation and molecular characterization of circulating viruses affecting livestock, poultry, and feral cats. Artificial intelligence tools are being designed to develop novel multiepitope–based vaccines for viral diseases of livestock, poultry, and cats. Antiviral therapies for viral diseases of cattle, poultry, and cats are also being developed.

Autoimmune diseases of animals and humans are the focus of Dr. Xiaolei Tang's research. His laboratory develops technologies that boost the functions of tissue-specific CD8+ and CD4+ regulatory T cells (Tregs). Engineered nanoparticles are being devised to stimulate CNS-specific CD8+ Tregs for treating chronic inflammation in the CNS. In addition, dendritic cells are engineered to locally deliver high concentrations of de novo–synthesized active vitamin D to enhance tissue-specific CD4+ Tregs to treat inflammatory bowel diseases. Tissue-specific targeting vehicles are used to deliver active vitamin D and retinoic acid to promote adult stem cell functions.