

**BIOMEDICAL & VETERINARY SCIENCES
GRADUATE PROGRAM**



ANNOUNCES

The Doctor of Philosophy Seminar
and Examination of

Shaohua Lei

**“Pathogenesis, immunity, and
prevention of human norovirus
infection in gnotobiotic pigs ”**

Tuesday, March 20, 2018

2:00 pm

Integrated Life Sciences Building (ILSB), Room 1040

Bio



Shaohua Lei came to Virginia Tech from Hunan University in China, where he earned his Bachelor's degree in Biotechnology and Master's degree in Biomedical Engineering. In the Fall of 2013, Shaohua joined the Interdepartmental Microbiology Training Program, and then transferred to BMVS and joined Dr. Lijuan Yuan's lab in December. The focus of his Ph.D. work has been the study of human norovirus infection using gnotobiotic pig model. Specifically, he investigated the effects of bacteria colonization, host immunity, and prebiotics/probiotics feeding on human norovirus infectivity. Shaohua also started his pursuit for a Master's degree in the Department of Computer Science in Fall 2016, focusing on Bioinformatics which is an emerging and promising biomedical research field. Shaohua hopes to continue his endeavor in the research field of intestinal microbiome, immunity, infection and disease.

Funded by

VMCVM Office of Research and Graduate Studies

Lay Language Abstract

Human noroviruses (HuNoVs) are the leading cause of viral epidemic acute gastroenteritis. Using the gnotobiotic pig model of HuNoV infection and diarrhea, we found that (1) the colonization of a commensal bacterium *E. cloacae* inhibited HuNoV infectivity, and B cells were not a target cell type for HuNoV in gnotobiotic pigs. (2) Increased and prolonged HuNoV infection in RAG2/IL2RG deficient pigs, which had severe combined immunodeficiency. (3) The dietary supplementation of rice bran and colonization of two probiotic bacteria significantly reduced HuNoV infectivity and diarrhea, and the beneficial effects were associated with enhanced intestinal immunity and health. Taken together, the dissertation work improves our understanding of HuNoV infection and immunity, and further supports for gnotobiotic pigs as a valuable model for future studies of human enteric virus infection, host immunity, and interventions.

Publications

Journal Articles:

Sheng J, Lei S, Yuan L, Feng X. 2017. Cell-free protein synthesis of norovirus virus-like particles. *RSC Advances* 7:28837-28840.

Bui T, Li G, Kim I, Wen K, Twitchell EL, Lei S, Ramesh AK, Weiss MD, Yang X, Glark-Deener SG, Choy RK, Yuan L. 2017. Effects of Racecadotril on Weight Loss and Diarrhea Due to Human Rotavirus in Neonatal Gnotobiotic Pigs (*Sus scrofa domestica*). *Comparative Medicine* 67:157-164.

Twitchell EL, Tin C, Wen K, Zhang H, Becker-Dreps S, Azcarate-Peril MA, Vilchez S, Li G, Ramesh A, Weiss M, Lei S, Bui T, Yang X, Schultz-Cherry S, Yuan L. 2016. Modeling human enteric dysbiosis and rotavirus immunity in gnotobiotic pigs. *Gut Pathogens* 8:51.

Lei S, Ramesh A, Twitchell E, Wen K, Bui T, Weiss M, Yang X, Kocher J, Li G, Giri-Rachman E, Trang NV, Jiang X, Ryan EP, Yuan L. 2016. High Protective Efficacy of Probiotics and Rice Bran against Human Norovirus Infection and Diarrhea in Gnotobiotic Pigs. *Frontiers in Microbiology* 7.

Lei S, Samuel H, Twitchell E, Bui T, Ramesh A, Wen K, Weiss M, Li

G, Yang X, Jiang X, Yuan L. 2016. Enterobacter cloacae inhibits human norovirus infectivity in gnotobiotic pigs. *Scientific Reports* 6:25017.

Lei S, Ryu J, Wen K, Twitchell E, Bui T, Ramesh A, Weiss M, Li G, Samuel H, Clark-Deener S, Jiang X, Lee K, Yuan L. 2016. Increased and prolonged human norovirus infection in RAG2/IL2RG deficient gnotobiotic pigs with severe combined immunodeficiency. *Scientific Reports* 6:25222.

Yang X, Twitchell E, Li G, Wen K, Weiss M, Kocher J, **Lei S**, Ramesh A, Ryan EP, Yuan L. 2015. High protective efficacy of rice bran against human rotavirus diarrhea via enhancing probiotic growth, gut barrier function, and innate immunity. *Scientific Reports* 5:15004.

Book Chapters:

Lei S, Twitchell E, Yuan L. 2018. Pathogenesis, immunity and the role of microbiome/probiotics in enteric virus infections in human and animal models. In *Mechanisms underlying host-microbiome interactions in pathophysiology of human diseases*. Edited by Sun J and Dudeja PK.

Lei S, Yuan L. 2018. Rice bran usage in viral diarrhea. In *Dietary Interventions in Gastrointestinal Disease: Food, Nutrients and Dietary Supplements*. Edited by Watson RR and Preedy VR. (in press)

Presentations

Lei S, Twitchell E, Ramesh A, Bui T, Hendricks A, Majette E, and Yuan L. Human gut microbiota enhances human norovirus infection. In Keystone Symposia: Microbiome, Host Resistance and Disease, Banff, Alberta, Canada. March 4-8, 2018. (Poster presentation)

Lei S, Ryu J, Twitchell E, Ramesh A, Bui T, Lee Kiho, Yuan L. Human norovirus infection in STAT1 deficient gnotobiotic pigs. In the 28th Annual BMVS Graduate Research Symposium, Blacksburg, USA. March 16th, 2017. (Poster presentation)

Lei S, Ramesh A, Twitchell E, Wen K, Bui T, Weiss M, Yang X, Kocher J, Li G, Giri-Rachman E, Trang NV, Jiang X, Ryan EP, Yuan L. High protective efficacy of probiotics and rice bran against human norovirus infection and diarrhea in gnotobiotic pigs. In the 6th

International Calicivirus Conference, Savannah, GA, USA. Oct 13th, 2016. (Oral presentation)

Lei S, Ryu J, Wen K, Twitchell E, Bui T, Ramesh A, Weiss M, Li G, Samuel H, Clark-Deener S, Jiang X, Lee K, Yuan L. Increased and prolonged human norovirus infection in RAG2/IL2RG deficient gnotobiotic pigs with severe combined immunodeficiency. In ASV 35th Annual Meeting, Virginia Tech, Blacksburg, USA. June 20th, 2016. (Oral presentation)

Lei S, Ryu J, Wen K, Twitchell E, Bui T, Ramesh A, Weiss M, Li G, Yang X, Samuel H, Clark-Deener S, Jiang X, Lee K, Yuan L. Human norovirus infectivity is inhibited by *Enterobacter cloacae* and promoted by RAG2/IL2RG deficiency. In the 27th Annual BMVS Graduate Research Symposium, Blacksburg, USA. March 17th, 2016. (Oral presentation)

Lei S, Giri-Rachman E, Kocher J, Li G, Wen K, Yang X, Weiss M, Yuan L. Probiotic bacteria and human norovirus interactions in vitro and in gnotobiotic pigs. In ASV 34th Annual Meeting, Western University, London, Ontario, Canada. July 11th, 2015. (Oral presentation)

Lei S, Giri-Rachman E, Kocher J, Li G, Wen K, Yang X, Weiss M, Yuan L. Probiotic bacteria and human norovirus interactions in vitro and in gnotobiotic pigs. In the 26th Annual BMVS Graduate Research Symposium, Blacksburg, USA. March 19th, 2015. (Poster presentation)

Awards and Academic Achievements

2016-2017 Outstanding Doctoral Student Award at Virginia Tech.

Award from the GSA Travel Fund Program at Virginia Tech
(December 2016).

Student Travel Grant in the 34th ASV annual meeting (July 2015).

Examination Graduate Committee

Major Advisor/Chair:

Lijuan Yuan, MS, PhD

Associate Professor

Department of Biomedical Sciences and Pathobiology, Virginia-Maryland College of Veterinary Medicine, Virginia Tech

Graduate Advising Committee Members:

Xiang-Jin Meng, MD, MS, PhD

University Distinguished Professor

Department of Biomedical Sciences and Pathobiology, Virginia-Maryland College of Veterinary Medicine, Virginia Tech

Xiaofeng Wang, MS, PhD

Assistant Professor

Department of Plant Pathology, Physiology, and Weed Science, College of Agriculture and Life Sciences, Virginia Tech

Andrew B. Allison, MS, PhD

Assistant Professor

Department of Biomedical Sciences and Pathobiology, Virginia-Maryland College of Veterinary Medicine, Virginia Tech

External Examiner

Jianrong Li, DVM, PhD

Professor, Department of Veterinary Biosciences

College of Veterinary Medicine

The Ohio State University

Mesenchymal Stem Cells as Therapy in Autoimmune Diseases

Tuesday, March 20, 2018

10:00 am

VMIA Classroom 220



VIRGINIA TECH.™