

Food Animal Health Research Program

Faculty Profiles



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



Gireesh Rajashekara,
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Professor, Interim Head
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Areas of Expertise

- Food Safety – *Salmonella* and *Campylobacter*
- Food Security
- Gut Microbiome
- Ecology and Epidemiology of Foodborne Pathogens
- Antimicrobial Resistance

Education

Postdoctoral Training – Emory University/ University of Wisconsin

PhD – University of Minnesota

DVM – University Agricultural Science, Bangalore, India

MVSc – University Agricultural Science, Bangalore, India

Food safety and antimicrobial resistance

Antimicrobial resistant (AMR) infections cause over 700,000 deaths annually, with a burden to the global economy in excess of \$2 billion. The dynamics and ecology of AMR emergence and dissemination are complex and the specific roles and contributions of medical, veterinary and agricultural uses of antibiotics in driving AMR are not fully understood. Research in the Rajashekara lab is focused on quantifying the impact of several plant health and disease management practices on the populations of antimicrobial resistant bacteria in the plant production environment. Research areas also include defining the epidemiology and ecology of foodborne pathogens in food animals; understanding the emergence of AMR in the preharvest environment; understanding molecular mechanisms of how these zoonotic pathogens interact with food animals as well as fresh produce; and developing novel diagnostics vaccines, therapeutics, and AMR mitigation through antibiotic alternative approaches for preharvest control of these zoonotic pathogens.

My laboratory is also interested in understanding how gut microflora modulates intestinal homeostasis and its impact on pathogenesis of enteric pathogens. Particularly, we are looking at how different lactic acid bacteria modulate host cellular pathways using system biology approach in a gnotobiotic pig model. Further we are interested in studying the interaction of different probiotic bacteria with enteric pathogens including rotavirus. Metagenomic and metabolomics studies are employed to quantitatively assess the changes in the gut microbiota and metabolites in response to malnourishment, rotavirus infection and probiotic treatments and assess how these treatments impact the microbiota/metabolic composition in different tissues of human infant fecal microbiota (HIFM pigs) transplanted gnotobiotic pig model.

Research in my laboratory is also focused on visualizing in real-time the dynamics of in vivo colonization of bacterial pathogens using novel methodologies. We have applied bioluminescent imaging combined with transposon mutagenesis to gain greater insight into plant-phytopathogens as well as plant-foodborne pathogens interactions to (i) monitor infection over time, (ii) identify sites of bacterial colonization, and (iii) study the dynamics of infection including patterns of growth and clearance of bacteria in specific tissues. We are also engaged in novel drug discovery against bacterial pathogens using high throughput screening of small molecules combined with real-time imaging assays to identify effective antimicrobial strategies to control foodborne pathogens.





Linda Saif, MS, Ph.D.
Distinguished University
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National Academy of
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Areas of Expertise

- Enteric, Respiratory, and Emerging Viruses
- Coronaviruses
- Rotaviruses
- Caliciviruses
- Mucosal Immunology
- Vaccine Development
- Zoonosis

Education

Honorary Diplomate, ACVM

PhD – The Ohio State University,
Columbus, OH

MS – The Ohio State University,
Columbus, OH

BS – The College of Wooster, Wooster,
OH

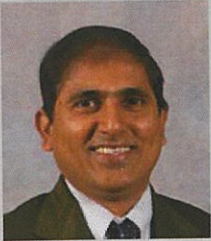
Virology, mucosal immunity, and vaccines

Viral gastroenteritis is a leading cause of neonatal morbidity and mortality worldwide in infants and animals, but vaccines often fail in impoverished countries or in neonatal animals. My lab has a long-term interest in passive (lactogenic) and mucosal immunity and enteric viral vaccines and adjuvants/immunomodulators for neonates including maternal vaccines to passively protect neonatal animals. We also conduct comparative studies of foodborne, enteric and respiratory viruses of humans and animals including caliciviruses (noroviruses and sapoviruses), rotaviruses and coronaviruses. Our focus is on investigating the interrelationships among animal viruses and their human counterparts to assess their zoonotic potential, mechanisms of interspecies transmission and potential vaccines, with an emphasis on emerging coronaviruses (SARS, MERS, PEDV, PDCoV, etc).

Another goal is the identification of new enteric viruses, characterization of their pathogenesis, and development of novel cultivation methods, diagnostic assays and vaccines for them. We developed and continue to utilize germfree large animal disease models to elucidate the pathogenesis of enteric viral infections, the correlates of intestinal immunity and to evaluate new approaches to enhance neonatal immunity and vaccines. A current goal is to investigate factors related to failure of enteric viral vaccines in infants in developing countries or in animals and to test new vaccination strategies in germfree piglets. We are currently investigating the impact of micronutrients (vitamin A deficiency), probiotics/commensals, and gut microbiome alterations on the development of neonatal immunity and protection against enteric viral infections and how these factors affect intestinal homeostasis, immunity and the pathogenesis of enteric viruses.

Our unique germfree animal models and innovative studies have led to improved oral vaccines, an understanding of maturation of neonatal mucosal immunity and insights into the beneficial effects of probiotics/commensals. Training in my lab focuses on veterinary and molecular virology as well as mucosal immunology, vaccinology and animal models of human disease.





Renukaradhya
Gourapura, DVM, MS,
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Areas of Expertise

- Influenza
- Porcine Reproductive and Respiratory Syndrome
- Salmonella
- Zoonotic Diseases
- Mucosal Vaccine Delivery Platforms
- Adjuvants and Immune Modulators

Education

Postdoctoral Training – Indiana University School of Medicine, Indianapolis, USA

PhD – Microbiology and Cell Biology, Indian Institute of Science, Bangalore, India

DVM and MS – Veterinary College, University of Agricultural Sciences, Bangalore, India

Viral and bacterial mucosal vaccines, large animal models, and microbiome

My laboratory research focus is on mucosal immunology in food animals infected with infectious and zoonotic diseases. Currently, mucosal delivery of vaccines is gaining increased attention due to its ability to improve cross-protective immunity against RNA viruses and primary mucosal pathogens. We are trying to develop innovative biodegradable and biocompatible polymer based nanoparticle vaccine delivery platforms to administer and target vaccine antigens efficiently to immune cells at mucosal sites. In animals vaccinated through intranasal or oral route, we are interested in understanding immune correlates of protection, and efficacy analysis following respective viral or bacterial challenge infection.

Particularly, focusing on improving the efficacy of inactivated whole pathogen and subunit vaccine antigens of influenza virus and porcine reproductive and respiratory syndrome virus delivered intranasally in pigs, and *Salmonella* vaccines delivered orally through drinking water in poultry. We are also evaluating immune modulators, bacterial-based and synthetic adjuvants, different polymers based vaccine carriers targeting toll-like receptors in mucosal immune inductive sites of food animals and poultry.

Broad areas of research include understanding the host pathogen interactions, microbial pathogenesis, developing pig model to reveal the influence of human microbiome on vaccines and diseases, and understanding immune evasion mechanisms in food animals infected with viral and bacterial pathogens. Other focus of research in the laboratory is on developing large animal models for biomedical, preclinical research in the areas of both infectious and non-infectious diseases to improve human health. Dr. Gourapura is leading a collaborative team of scientists at USDA research facilities in Maryland and Iowa and Dr. Kenney from FAHRP, in developing new swine immune reagents and their evaluation through functional and phenotypic analysis.





QiuHong Wang, BM,
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Areas of Expertise

- Virology
- Emerging and Re-emerging Infectious Diseases
- Molecular Mechanism of Attenuation in Vaccine Development
- Food Safety
- Cell Culture Adaptation of Enteric Viruses
- Interspecies Transmission
- Porcine Epidemic Diarrhea Virus (PEDV)
- Caliciviruses (Norovirus, Sapovirus, etc.)

Education

Postdoctoral Training – Medical College of Wisconsin

PhD – The Ohio State University, Columbus, OH

MS – University of Tokyo, Japan

BM – Beijing Medical University (Peking University), Beijing, China

Combating enteric viruses to improve animal and human health

Diarrhea is the second leading cause of death among children under the age of 5, and is a common disease for young animals. My current research focus is on enteric caliciviruses and coronaviruses, including diagnosis of viral infections, molecular epidemiology, adaptation of enteric viruses in cell culture, mechanisms of virus attenuation, interspecies transmission of viruses, the mechanisms of enteric virus transmission through leafy greens, and the development of vaccines using conventional and reverse genetics technologies.

Porcine epidemic diarrhea virus (PEDV) causes a high mortality rate (up to 100 percent) in neonatal suckling pigs. To control the disease, an effective vaccine is urgently needed, but none is available in the US. From the studies of other swine enteric viruses (such as rotavirus and transmissible gastroenteritis virus) we know that oral immunization of sows with live attenuated vaccines is the most effective approach to protect newborn piglets against enteric viruses, including the highly virulent PEDV. However, knowledge of the molecular attenuation mechanisms of PEDV and other genetically related coronaviruses is limited. Our laboratory exploits conventional (e.g., cell culture adaptation) and state-of-the-art (e.g., reverse genetics) technologies to generate PEDV strains with reduced virulence, to identify genomic hot spots related to attenuation, and to generate PEDV vaccine candidates. The knowledge gained will advance the development of a safe attenuated PEDV, and will aid in innovative vaccine design against other fatal animal and human coronavirus diseases, such as severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS).

Human noroviruses (HuNoVs) are the leading cause of foodborne illnesses in the US. Contaminated food is a major transmission vehicle for this virus. Among all kinds of foods, leafy greens are ranked number one in norovirus-outbreaks, followed by fresh fruits/nuts and shellfish. Our laboratory studies the mechanisms of HuNoV binding to leafy greens, how viral particles are transported from roots to leaves, and if they retain infectivity in plants. Such knowledge will lead to develop technologies to control HuNoV contamination of leafy greens.





Scott P. Kenney, Ph.D.
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Areas of Expertise

- Molecular Virology
- Emerging Infectious Diseases
- Vaccine Development
- Hepatitis E Virus
- Porcine Diseases
- Reverse Genetic Systems
- Zoonosis

Education

Postdoctoral Training – Virginia Tech,
Blacksburg, VA

PhD – Microbiology & Immunology, The
Pennsylvania State University College
of Medicine, Hershey, PA

BS – Animal Bioscience, The
Pennsylvania State University, State
College PA

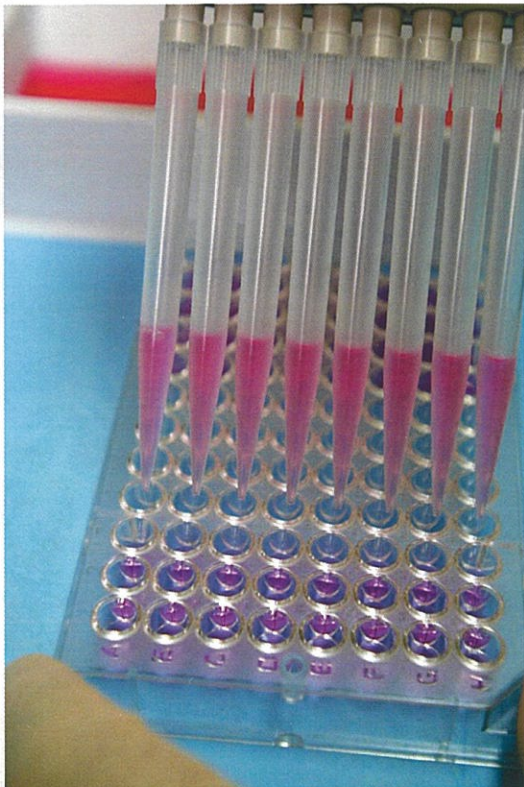
Molecular virology of positive stranded RNA viruses

The Kenney Lab focus is on understanding how (mostly) positive stranded RNA viruses interact with their hosts through the use of viral infectious clones and reverse genetic systems. Currently, we work on hepatitis E virus (HEV), porcine reproductive respiratory syndrome virus (PRRSV), and porcine deltacoronavirus (PDCoV).

Our primary focus is hepatitis E virus, a positive-sense RNA virus that is one of the leading causes of acute viral hepatitis worldwide. HEV is endemic to developing countries where poor sanitation enhances the fecal oral transmission of the virus. Typically, healthy individuals recover from HEV infections but in pregnant women the mortality rate can reach 25 percent. HEV is also recognized as a zoonotic disease and can be transmitted from animals to humans in developed countries. Currently, there are 4 genotypes of HEV of human importance; genotypes 1 and 2 solely infect humans and genotype 3 and 4 infect animals (pigs, rabbits, deer) and humans. We are interested in determinants that allow for cross species transmission and pathogenesis of HEV and in the development of animal model systems to understand HEV pathology in the host. Being difficult to propagate in cell culture has led to knowledge of many aspects of the viral lifecycle lagging behind better studied viruses. Recently, a cell culture adapted strain of genotype 3 HEV was discovered from a chronically shedding patient. This virus picked up the human ribosomal protein S17 as part of its genome. We are utilizing this virus strain to understand both how S17 is contributing to virus replication and host range and to characterize HEV-host interactions.

In addition to HEV, we work on swine diseases including porcine reproductive and respiratory syndrome virus PRRSV. PRRSV is a major agricultural pathogen of pigs costing swine farmers more than \$650 million dollars annually due to the illnesses it causes in pigs. PRRSV is difficult to control through vaccination due to the poor production of broadly neutralizing antibodies. Protection against 1 strain of the virus typically is not protective against heterologous circulating strains. We are attempting to better understand the virus host interactions leading to poor cross protective adaptive immune responses to improve existing modified live vaccines.

Finally, our most recent research concerns cross species transmission of PDCoV. In collaboration with Dr. Bosch at Utrecht University, we showed PDCoV utilizes a conserved domain on the host protein aminopeptidase N to gain entry into cells from a wide variety of species. We followed up those studies by showing PDCoV can indeed infect commercial poultry. We are currently pursuing studies on PDCoV as both an agricultural and zoonotic health threat.





Anastasia N. Vlasova,
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Areas of Expertise

- Innate Immunity
- Viral Disease Pathogenesis and Immunity
- Neonatal Immunity
- Intestinal Microbiome
- Dietary-Immune Interactions
- Gnotobiotic Animal Models
- Epidemiology

Education

Postdoctoral training – The Ohio State University, Columbus, OH

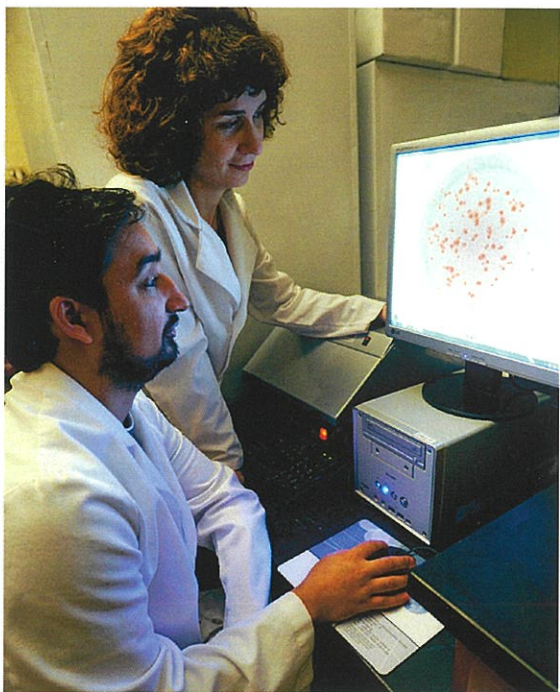
PhD – Virology, Molecular Epidemiology, Ivanovsky Institute for Virology, RAMS

DVM – Biotechnology/Biochemistry, Moscow State Academy of Veterinary Medicine and Biotechnology

Animal models: defining strategies to achieve optimal immune responses at the mucosal interphase

My research is focused on the pathogenesis, epidemiology and immunity to enteric viruses including corona: (CoVs) and rotaviruses (RVs). Rotavirus is the leading cause of childhood diarrhea and mortality worldwide and an important pathogen in young animals; CoVs represent a continuous public health threat evidenced by recent trans- boundary spread and pandemics of animal (porcine epidemic diarrhea virus, deltacoronavirus) and human (severe acute respiratory syndrome CoV, SARS-CoV, and Middle Eastern respiratory syndrome CoV, MERS-CoV) CoVs. My recent results using the gnotobiotic pig model demonstrated that coordinate involvement of different innate immune cells (specifically, plasmacytoid dendritic and natural killer cells) is critical to mount optimal immune responses against human RVs. I further utilize this model to understand the influences of various commensal and probiotic bacteria and the microbiota, as well as of pathological conditions, including vitamin A deficiency, malnutrition and intestinal dysbiosis that compromise innate immune responses to mucosal pathogens, further affecting protective efficacy of mucosal vaccines.

I also have a long-standing interest and extensive training and expertise in molecular virology and in comparative molecular characterization of emerging human and animal CoVs. The results of these studies demonstrate that porcine RVs currently circulating in swine may possess zoonotic potential and may represent potential threats to public health. Additionally, recent results confirm complex and fast evolution of different CoVs of significant economic impact and public health concern. Such information is critical for development of accurate diagnostic tools, control measures, understanding mechanisms of interspecies transmission/evolution of viral pathogens, and for enhancement of the immune responses at the mucosal interphase. Overall, these research projects contribute to both basic science and translational biomedical research.





*David Benfield, Ph.D.
Professor, Associate
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Agricultural
Administration
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Areas of Expertise

- Porcine Reproductive and Respiratory Syndrome
- RNA Viruses
- Enteric Viruses
- Reproductive Viruses
- Respiratory Viruses

Education

PhD – Microbiology, University of Missouri-Columbia

MS – Virology, Purdue University

Dr. David Benfield is the Associate Vice President of Agricultural Administration in the College of Food, Agricultural, and Environmental Sciences and Director of the college's Wooster campus, which includes the Ohio Agricultural Research and Development Center (OARDC) and the Ohio State Agricultural Technical Institute (ATI). He is responsible for the operations of the Wooster campus, and associated research infrastructure, federal projects and capital planning.

Dr. Benfield is a renowned virologist for his contributions to food-animal health research. He co-discovered and described the Porcine Reproductive and Respiratory Syndrome (PRRS) virus in the early 1990s and helped develop the first vaccine against this serious disease. His research on PRRS has resulted in nine U.S. patents and several foreign patents.

Dr. Benfield is one of the founding members of Rural Technologies, Inc. He is a member of the American Society for Virology, American Association of Veterinary Laboratory Diagnosticians, and Honorary Diplomat of the College of Veterinary Microbiologists, American Association of Swine Veterinarians, and the American Association for the Advancement of Science. He is currently the Executive Director of the Conference of Research Workers in Animal Diseases.



*Yehia Mohamed "Mo"
Saif, DVM, MS, Ph.D.
Professor Emeritus,
Emeritus FAHRP Chair
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Areas of Expertise

- Diseases of Poultry and the Immune Response of Avian Species
- Infectious Bursal Disease Virus
- Enteric Viruses of Turkeys
- Development of Methodologies for Study and Diagnosis of Viral Infections

Education

Diplomate, ACVM

Charter Diplomate, ACPV

DVM – Cairo University

PhD – The Ohio State University

MS – The Ohio State University

Dr. Saif's administrative responsibilities included leadership of the Food Animal Health Research Program, Assistant Dean, College of Veterinary Medicine. He conducted research and taught and trained graduate students in the areas of infectious disease and the immune response of poultry. He developed and conducted Ohio State University Extension programs. Served as organizer of the Ohio Poultry Team and provided leadership and expertise at the local, national and international arenas in the area of animal health. Respiratory, enteric and immunosuppressive diseases, basic and applied studies on the immune response of poultry are areas actively investigated in the recent past. Dr. Saif retired Jan. 31, 2013.



*Juliette Hanson, DVM,
MPH
PAAR Director,
OARDC Veterinarian
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(330) 263-3752*

Areas of Expertise

- Veterinary Medicine
- Plant Animal Agrosecurity Research (PAAR)
- BSL-3 Training
- IACUC

Education

DVM – University of Minnesota, St. Paul, MN

MPH – The Ohio State University, Columbus, OH

BA – St. Olaf College, Northfield, MN

Dr. Hanson and the animal care group for FAHRP provide animal care, surgical and procedural services for research in FAHRP facilities including Specific Pathogen Free turkey and chickens flocks, swine and bovine gnotobiotic facilities and several biosafety level 2 facilities for housing agricultural animals in support of infectious disease research. All research activities are monitored to ensure regulatory compliance with USDA, IACUC and AAALAC international.

Dr. Hanson also serves as Director of the Plant Animal Agrosecurity Research (PAAR) facility, which houses a state of the art facility for work with plant and animal pathogens at biosafety level 3 Agriculture. In addition, she is the veterinarian for OARDC and ATI providing clinical services and regulatory oversight for agricultural animals in research and teaching at the Wooster campus.

Ralph Regula Plant and Animal Agrosecurity Center (PAAR)

The PAAR facility is a highly secure biocontainment building. It is required by federal law for conducting research with organisms that cause diseases in animals classified at biosafety level 3 (BSL-3 and/or BSL-3 Ag). It is also needed for working with plant diseases that could cause undue economic hardship on agriculture if released into the environment.

PAAR is the only facility in Ohio and one of only two nationally with capacity for both plant and animal research at the BSL-3 and BSL-3 Ag safety levels. Another three facilities nationwide have the BSL-3 Ag safety level designation for animal-related research only. The Ohio State University operates several BSL-3 labs on its Columbus campus, but PAAR IS be the first BSL-3 facility on the Wooster campus and the university's first BSL-3 Ag facility.

PAAR enhances OARDC's nationally and internationally recognized research programs on infectious diseases of plants and animals — further contributing to the viability of Ohio's \$90-plus billion agricultural sector, the state's largest industry. The facility allows Ohio to proactively develop new diagnostic tools, treatments, vaccines, and genetically resistant animals and plants to reduce economic losses from diseases and pests. It also enhances OARDC's ability to attract highly competitive faculty and grants to the state.



- 27,537 gross sf and 23,000 assignable sf.
- Two BSL-3 enhanced laboratories and four BSL-3 Ag animal isolation rooms that can handle large animals.
- Office, lockers and change facility, decontamination areas, wash areas to clean cages, and a necropsy area for sample collection.
- Specialized equipment to work with microorganisms in laboratory settings.
- Special airtight construction.
- Outgoing air is filtered through HEPA filters that trap microorganisms and prevent escape into other sections of the facility and the surrounding environment.
- Complies with all federal guidelines governing BSL-3 and BSL-3 Ag labs.

Food Animal Health Research Program

Mission

The mission of the Food Animal Health Research Program (FAHRP) is to protect and enhance animal and public health through research, education, and outreach, and to support the animal industries in economically producing safe, wholesome food in an environmentally and socially responsible manner.

Research Focus

Emerging pathogens, zoonoses, and microbial contamination of food and the environment threaten agricultural productivity, sustainability, and public health worldwide. FAHRP's research focus is on pathogenesis, epidemiology, prevention, and control of animal disease. Our emphasis is on basic and translational studies on enteric, respiratory, and immunosuppressive diseases and the zoonotic potential of these diseases as well as food and environmental safety.

Respiratory and enteric diseases are the most economically significant diseases affecting food producing animals. Our interest and experience with enteric diseases led us to the areas of food and environmental safety since most of the pathogens involved in these areas reside naturally in the gastrointestinal tracts of food producing animals. Food and environmental safety and zoonoses are of significant public health concern.

We maintain a strong research portfolio that is relevant, focused, productive, and sustainable. It is nationally and internationally recognized for excellence and cutting-edge research. Our work has resulted in a knowledge base to combat infectious diseases and in the development of vaccines, diagnostic reagents and tests.

Fundamental science discoveries and applied research are used to respond to the economic, social, and environmental challenges facing agriculture and public health today and prepare responses for the unexpected challenges of tomorrow. Through effective outreach activities, these scientific contributions will positively impact Ohioans, the nation, and the global community.



Our program focuses on enhancing food safety, protecting the environment, and making animals and people healthier.



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AND ENVIRONMENTAL SCIENCES

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