LETTER FROM OUR INTERIM ASSOCIATE DEAN FOR RESEARCH AND ADVANCED STUDIES

Strong research programs are integral to the LSU School of Veterinary Medicine (SVM) environment, where the creation of new knowledge allows us to address and solve practical problems. Intrinsic to our vibrant research program is a quality graduate training program that attracts the best students.

The SVM extramurally funded research program is internationally recognized. Our powerful research thrusts in both biomedical and veterinary medical fields garners major continuous funding from federal agencies such as the National Institutes of Health (NIH), the United States Department of Agriculture, the Department of Defense and the National Science Foundation. In addition, substantial funding has come from industry and animal health foundations such as the Morris Animal Foundation and the Grayson Jockey Club. Currently, grants and contracts held by SVM faculty total $39.4 million (80 percent is from federal agencies). Total annual research expenditure is currently $13.2 million. Over the past five years, competition for federal and industrial grants has increased and the national success rate of awards has decreased considerably. In spite of this, the funding success rate of grants submitted by SVM faculty is maintained at an outstanding 37 percent. Faculty and student communication of significant research findings in high impact refereed publications continues at a high level, and presentations at scientific and professional meetings continue to increase as faculty promote their work at international, national and local venues.

The SVM faculty participate in vital collaborations with the LSU Colleges of Science, Agriculture and Engineering; the Pennington Biomedical Research Center; the LSU Health Sciences Centers; the Tulane University School of Medicine; and other universities and governmental agencies. The Center for Experimental Infectious Disease Research (CEIDR) and the IDeA Network for Biomedical Research Excellence (INBRE) are funded through the NIH. Within the CEIDR, our research strengths concentrate on bacterial, viral and parasitic infectious diseases; vector biology; and molecular medicine. The Equine Health Studies Program remains an integral part of our program, specifically addressing the unique aspects of research related to horses and directly supporting the Louisiana horse industry.

Our Summer Scholars Program provides the opportunity for as many as 24 first- and second-year DVM students to discover basic and clinical research; this program is supported by training grants from the NIH (in collaboration with the Tulane National Primate Research Center [TNPRC]) and grants from the Morris Animal Foundation and Merial. Another training grant supports graduate veterinarians in experimental pathology and medicine as part of the CEIDR. These training grants and our research programs are consistent with the philosophy of One Medicine/One Health, which focuses on how human and animal medicine work together for the betterment of all species.

This brief description of research activities in the SVM serves to introduce the outstanding faculty and students who instill excitement and energy into our search for new knowledge in human and animal health.

Sincerely,

James E. Miller, DVM, MPVM, PhD
ON THE COVER
A scanning electron microscope image of rope-like structures called Neutrophil Extracellular Traps (NETs) trapping bacterial cells in order to confine and eliminate microbes. These neutrophils were isolated from mouse bone marrow and infected with bacteria.

ON THE BACK COVER
From left, researchers with a minimum of $1 million in grant funding are Drs. Gary Wise, Shisheng Li, Samithamby Jeyaseelan, Masami Yoshimura, Kevin Macaluso, Fang-Ting Liang, Joseph Francis and Steven Barker. Not pictured are Drs. Konstantin “Gus” Kousoulas, Thomas Klei and Christopher Mores.

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The LSU School of Veterinary Medicine (SVM) employs scientists who are investigating an array of diseases and injuries that affect both people and animals. Our research endeavors include projects related to infectious diseases, cell and molecular biology, and veterinary clinical sciences.

Extramural Research Funding

Research could not take place without funding. Total extramural funding for the LSU SVM’s research programs in 2012-13 was $42.6 million, with the majority coming from the federal government, followed by state, foundation and industry funds. These funds contribute to biomedical research in the areas of infectious disease, cancer biology, molecular medicine, equine research, small animal research, wildlife research and research training.

In 2012-2013, LSU SVM faculty submitted more than 100 proposals; more than 40 proposals received funding totaling more than $30 million. The LSU SVM is one of nine veterinary schools in the U.S. to receive more than $6 million in NIH funding in four of the last seven years. These dollars not only fund research; they also directly affect the Louisiana economy because most of these funds are spent here.
Research by Academic Department

Comparative Biomedical Sciences

The common thread that unites CBS research is cell and molecular biology, which is wide-reaching. Researchers are investigating DNA repair, cancer and cardiovascular physiology, as well as areas with direct applications to human and veterinary patient care, including stem cell biology for tissue regeneration; multiple sclerosis and the role of specific proteins in T-cell activation; and alcoholism and the action of alcohol on signal transduction pathways.

Cell and molecular techniques are also utilized in development and physiology, including studies on the molecular basis of tooth eruption, the molecular genetics of deafness in Dalmatians and other breeds, and analysis of zebrafish development in relation to environmental health science. Also, researchers are studying the development and anatomy of the bowhead whale and the functional anatomy of its digital end organs.

Pathobiological Sciences

PBS is currently ranked #1 in research productivity at LSU. The research emphasis is on infectious diseases, with strong programs in viral and bacterial pathogenesis, immunity and resistance to infectious agents, vector-borne diseases, and the use of Geographic Information Systems to study disease distribution and risk factors.

The department’s strong vector-borne diseases research program investigates human and animal diseases carried and transmitted by insects or other arthropods such as ticks. These diseases can be caused by viruses, bacteria or macroparasites and can affect both humans and animals. Colonies of the appropriate vectors for these agents are maintained in the SVM. Researchers in the Vector-Borne Diseases Laboratories investigate pathogen-host interactions that drive pathogenesis and transmission and develop novel vaccines. A robust graduate and professional training program and state-of-the-art equipment (including high-throughput sequencers) and containment facilities (certified BSL-3 for infected vertebrate and arthropod experimentation) support the research.

PBS also has a strong research program in respiratory diseases that investigates human and animal respiratory infectious and inflammatory diseases. Researchers in the Respiratory Disease Laboratories investigate the immunological basis of host-pathogen interactions that eventually induce bacterial and viral pneumonia. Lung inflammatory diseases caused by second-hand smoke are also investigated. The research is well funded by the National Institutes of Health and the Flight Attendant Medical Research Institute and provides a robust graduate and professional training (summer scholar) program. State-of-the-art equipment, including fully automated inhalation exposure chambers and anatomic/clinical pathology services, supports the activities of the group.

Close associations with the National Hansen’s Disease Center (with its internationally recognized programs exploring tuberculosis and leprosy), the Pennington Biomedical Research Center and the Tulane National Primate Research Center provide additional opportunities for collaborative research and graduate training. Several faculty hold joint appointments in the LSU AgCenter Veterinary Science Department, and the aquatic animal disease faculty work closely with the LSU Aquaculture Research Station.

2012-13 Total Active Research Funding by Source

Total Extramural Funding: $39.4 million

Extramural Sources:
Federal (National Institutes of Health, United States Department of Agriculture, Department of Defense, National Science Foundation, Department of Education), State of Louisiana, Foundations and Industry
Veterinary Clinical Sciences

VCS instructs veterinary students, interns and residents in the art and science of veterinary medicine, undertakes clinical research for the benefit of both animals and humans, and provides specialized care for animal patients from Louisiana and surrounding states.

VCS faculty are engaged in a wide variety of research endeavors, with major funding in equine laminitis and orthopedics. Research primarily relates to animal disease, though some research has implications in human medicine (e.g., research in glaucoma, orthopedics and oncology). In many areas, the research produces cutting-edge treatment for our patients. For example, research in renal disease has made LSU one of only four schools of veterinary medicine in the U.S. to offer hemodialysis and one of only 10 to offer renal replacement therapy (a form of continuous dialysis). Collaboration between faculty often helps translate the results of basic research into practical applications. Cardiovascular research and oncology are two areas with strong collaborative endeavors.

2012-13 Distribution of Total Active Research Funding through Extramural Grants and Contracts by Scientific Category

SVM Total Number of Proposals Submitted and Awarded (2007-12)

SVM Total Funds Requested and Awarded (2007-12)
The School of Veterinary Medicine offers advanced studies in a variety of contemporary biomedical sciences leading to an advanced degree and/or specialized professional training in one or more clinical specialties of veterinary medicine. Ranked the #1 program in veterinary studies by www.graduateprograms.com in 2013, the LSU SVM’s advanced studies program offers both MS and PhD degrees.

**Comparative Biomedical Sciences**

Graduate training offers students the opportunity to specialize in biomedical research in one or more of the various disciplines in the department. Broadly, these disciplines are grouped into three areas: 1) cell and molecular biology of cancer—e.g., metastasis, DNA repair mechanisms and gene therapy; 2) cell and molecular biology in development and physiology—e.g., initiation of tooth eruption, role of cytokines in primary heart failure, diagnostic neurophysiology, auditory cortex processing, ion channels in insulin release, stem cells and signal transduction; and 3) environmental health science—e.g., inhalation toxicology, aquatic species pharmacology and toxicology, and analytical pharmacology and toxicology. Other areas of expertise in the department include cetacean morphology, cellular ultrastructure, bone healing and neurochemistry.

**Pathobiological Sciences**

This graduate education program attracts candidates with DVM or equivalent degrees and students with bachelor’s or master’s degrees in microbiological, immunological, zoological or biomolecular sciences. Developing intellectual abilities and research skills through investigations of infectious diseases of food-producing, companion and aquatic animals is emphasized, as well as animal models for human disease. The interdisciplinary faculty, with expertise in molecular biology of infectious diseases, parasitology and immunology, as well as well-equipped laboratories, provide a stimulating environment for graduate training. Depending on individual interest, graduate students may choose courses with an emphasis in immunology and molecular virology, bacterial or viral pathogenesis, or parasitology and parasite-induced diseases. Communication skills are fostered through active research discussion groups, interdisciplinary seminars, oral examinations, presentation of papers at scientific meetings, and publication of research findings.

This academic and scientific program develops uniquely trained scientists who are able to contribute to improved health through vaccine development and modulation of the immune response. Graduates are able to investigate the pathogenesis and disease mechanisms of existing and newly emerging animal and human pathogens to advance animal and human health through research. Graduates may qualify for examination by the American College of Veterinary Microbiologists and gain academic, industrial and governmental positions.

The graduate professional residency programs in the department emphasize post-DVM education that leads to a PhD degree. An MS degree is also available. The programs offer an in-depth educational experience in classical morphological pathology, clinical pathology, or laboratory animal medicine. Completion of the residency program partially satisfies the eligibility requirements for the board examination of the American College of Veterinary Pathologists or the American College of Laboratory Animal Medicine. Research opportunities encompass the research programs of the entire School of Veterinary Medicine.

**Veterinary Clinical Sciences**

This department offers veterinarians who have a fundamental background in clinical sciences the opportunity to study disease problems in small, large and exotic animals. Most faculty of the department are concurrently assigned to the LSU Veterinary Teaching Hospital where they provide in-depth clinical training to professional students while serving the animal health needs of the hospital’s clientele. The hospital program is supported by a large and diverse staff that includes veterinary interns and residents, medical technologists, radiology technologists and pharmacists. Advanced training in clinical sciences prepares veterinarians for careers in clinical research and teaching and administration of clinical trials in the private and governmental sectors. Faculty research interests and areas of expertise range from basic research in immunogenetics to applied studies of surgical and medical problems. VCS also provides graduate professional training to interns and residents through the Veterinary Teaching Hospital.
Herpes virus as seen under the transmission electron microscope.
The emergence and re-emergence of worldwide epidemics of bacterial and viral infections have shown that infectious diseases pose international challenges of unparalleled complexity. Infectious diseases cause approximately one quarter of all deaths worldwide and two-thirds of all deaths among children younger than 5. Pathogens have emerged in unpredictable patterns as the result of changes in host-pathogen interactions, human demographics and behavior, and many other mechanisms. Malaria and tuberculosis (TB) kill millions of people every year, and the emergence of multi-drug-resistant TB has already created considerable treatment problems.

Despite worldwide efforts and the rapid development of potent antiviral drugs, AIDS has become one of the deadliest pandemics in history. The World Health Organization estimates that more than 25 million men, women and children have died worldwide. In the United States, more than 1 million people are living with HIV infection, and approximately 40,000 new infections occur each year. For the second year in a row, the Baton Rouge metropolitan area has the highest per capita rate of new AIDS cases in the nation (according to 2011 data from the CDC), while New Orleans ranked fourth.

Vector-borne diseases continue to contribute to the global infectious disease burden, and nearly half of the world’s population is infected with at least one type of vector-borne pathogen. Lyme and other tick-borne infections continue to cause substantial disease worldwide, and an epidemic of dengue fever was recorded in Asia during the summer of 2007.

Louisiana has a semi-tropical climate that supports the dissemination of many vector-borne disease pathogens. In addition, according to U.S. Census data for 2006-2010, 18.1 percent of Louisiana’s citizens live below the poverty line, and Louisiana is one of the portal states where many immigrants enter from Latin America and elsewhere. Global warming has produced significant changes in the world’s climate, and tropicalization of the southern U.S. is allowing the northward movement of dengue fever and other vector-borne diseases. The Center for Experimental Infectious Disease Research (CEIDR) established at the LSU School of Veterinary Medicine (SVM) allows Louisiana and other southern states to develop advanced research capabilities to combat infectious diseases, and especially vector-borne diseases at their point of origin.

Establishment of the Center

In addition to educating future veterinarians and treating animals in the Veterinary Teaching Hospital, the LSU SVM is a premier biomedical research facility. The CEIDR, an offshoot/byproduct of the ongoing collaboration between LSU and the Tulane National Primate Research Center (TNPRC), has been funded for the last 10 years by the National Institutes of Health (NIH), National Center for Research Resources (NCRR)/National Institute of General Medical Sciences (NIGMS) Centers of Biomedical Research Excellence (COBRE) program. The CEIDR will operate under the current COBRE organizational structure led by Dr. Konstantin “Gus” Kousoulas.

Mission

The mission of the CEIDR is to conduct collaborative and interdisciplinary research in infectious diseases and host response to infections; train pre-doctoral students and post-doctoral fellows, including veterinary students and clinical fellows; foster university-wide interest in infectious diseases through seminars and colloquia; and coordinate available infrastructure and core facilities in support of infectious disease research.
The CEIDR aims to become a nationally competitive Center of Excellence in the investigation of infectious diseases of humans and animals and a significant contributor to LSU and local and state-wide economic development efforts. The CEIDR will ultimately seek to enlist and involve all competitive LSU faculty working on infectious diseases, as well as infectious disease researchers in other Louisiana-based institutions.

It is anticipated that the CEIDR’s expansion will be instrumental in successfully competing for continued funding of the existing COBRE, and retaining and recruiting competitive faculty. It is anticipated that the appropriate infrastructure for research in infectious diseases, including equipment and other resources, will be maintained and expanded by the CEIDR. Currently, more than 40 faculty are studying infectious diseases and related fields at LSU and the TNPRC. Collaboration between investigators is facilitated by a broadband access grid that enables researchers to join live seminars anywhere in Louisiana. This access grid network is supported by the Louisiana Biomedical Research Network (LBRN) linking primary undergraduate institutions to LSU as the flagship campus. LBRN is funded by an NIH:NIGMS IDeA Network for Biomedical Research Excellence (INBRE) grant to LSU.

**Research Focus**

CEIDR faculty research focuses on acute viral, bacterial and parasitic pathogens of worldwide significance, including dengue fever virus, West Nile virus (WNV), *Borrelia burgdorferi* (Lyme disease), bacteria-causing pneumonia, filariasis parasites and other important pathogens. Common themes among all current research efforts are the molecular biology and immunopathogenesis of host-pathogen interactions. The CEIDR will expand into areas in immunopathogenesis and vector-borne diseases and develop new areas in molecular epidemiology and bioinformatics to complement current efforts. Efforts by CEIDR faculty to understand the life cycle of many important pathogens of animals and humans will result in effective vaccines and other therapeutics to combat serious infectious diseases and provide a sustainable base for local and state-wide economic development.

**Vector-Borne Diseases Program**

Many of the CEIDR faculty at the LSU SVM and the TNPRC conduct research on the pathogenesis and molecular biology of the most severe emerging and re-emerging vector-borne diseases. A strong research emphasis on arthropod-borne pathogens includes tick-
borne Spotted Fever Group *Rickettsia*, *Borrelia burgdorferi* and *Ehrlichia spp.*; flea-borne *Bartonella* and *Rickettsia*; and mosquito-borne filariasis and viral infections (West Nile, Eastern Equine encephalitis and St. Louis encephalitis). Additionally, Geographical Information Systems (GIS) and simulation techniques are used to predict vector-borne disease outbreaks. LSU scientists working on vector-borne diseases include all CEIDR-LSU scientists who are supported through the GeneLab Core Laboratory (GeneLab), Protein Core Laboratory (PCL) and the Molecular Immunopathology Core (MIPC). The MIPC is a consortium of facilities that provides support for microscopy, pathology and immunology at both LSU and the TNPRC.

**Rickettsial Disease**

Dr. Kevin Macaluso focuses on tick- and flea-borne rickettsial diseases and how the interactions between arthropods and rickettsiae facilitate pathogen transmission. Dr. Juan José Martinez is investigating mechanisms by which the Spotted Fever Group *Rickettsia* bind and invade target host cells. Dr. Monica Embers compares the primate immune response and the infection of non-human primates via intradermal *R. parkeri* needle inoculation versus ticks fed first with *R. parkeri* and then allowed to infect rhesus macaques.

**Dengue**

Dr. Christopher Mores develops computational tools to investigate the emerging potential of dengue and other vector-borne pathogens. He is also investigating molecular aspects of dengue virus pathogenesis using a murine model system. Dr. Noboku Wakamatsu Utsuki directs the MIPC pathology support services. Her current interests are in the immunopathogenesis of dengue infections, and she collaborates with Dr. Sujan Shresta on dengue virus projects in both human fatal cases and mouse models. Dr. Kousoulas studies the production of subunit and viral vectored vaccines for dengue virus in collaboration with Dr. Alistair Ramsay.

**West Nile Virus**

Dr. Alma Roy studies the diagnosis and pathogenesis of WNV and other arboviruses and, in collaboration with Dr. Kousoulas, is producing and testing a novel vaccine against WNV in horses. Dr. Kousoulas has sequenced and generated the phylogenetic relationships of more than 100 WNV strains.

**Lyme Disease**

Lyme disease is the most common vector-borne illness in North America and Europe. Dr. Fang-Ting Liang investigates how the causative agent *Borrelia burgdorferi* evades the immune system and identifies bacterial factors responsible for the induction of inflammatory pathology in murine models. Dr. Mario T. Philipp focuses on the pathogenesis of Lyme neuroborreliosis of the central and peripheral nervous systems using the non-human primate (NHP) animal model. Dr. Embers compares the genomic and transcriptional profiles of *B. burgdorferi* spirochetes exposed to doxycycline with untreated spirochetes.

**Epidemiology**

Dr. Mores also studies the mechanisms by which arboviruses persist in, emerge from and expand to particular ecologies, transmission cycles and regions. He also leads an NIH-program project grant that develops computational tools to investigate the emerging potential of dengue and other vector-borne pathogens. Dr. John B. Malone uses geographic information systems to predict parasitic disease outbreaks.

**HIV**

CEIDR members have mounted massive research efforts into human immunodeficiency virus (HIV) infections. Studies include determining the origins of epidemic forms of HIV from Simian immunodeficiency virus (SIV) in Africa, understanding changes occurring in the blood-brain barrier and gastrointestinal changes as the result of HIV/SIV infection, assessing humoral and cellular immune responses to HIV/SIV in nonhuman primates, and developing an extensive microbicide program to test the safety and efficacy of potential HIV preventatives using the nonhuman primate model of HIV transmission. Included in this major effort are Dr. Marcelo Kuroda, Dr. Preston A. Marx, Dr. Ronald S. Veazey, Dr. Bapi Pahar, Dr. Andrew MacLean, Dr. Mahesh Mohan and Dr. Nicholas J. Maness.
Herpesvirus

The CEIDR has a focus on herpesvirus infection. Dr. Kousoulas studies the molecular biology and immunopathogenesis of herpes simplex viruses and human herpesvirus 8 (HHV-8) or Kaposi’s Sarcoma-Associated Herpesvirus (KSHV). Dr. Muzammel Haque studies the pathogenesis of KSHV, focusing on regulatory protein-protein interactions that determine viral latency and reactivation, and Dr. Shafiqul Chowdhury is engaged in herpes virus-related vaccine development.

Immunopathogenesis

Substantial CEIDR research is trained on immunopathogenesis of infectious disease. Dr. Antonito Panganiban focuses on RNA virus replication and pathogenesis of emerging vector-borne viruses with a particular interest in category A, B and C bunyaviruses. Dr. Andrew A. Lackner studies the pathogenesis of infectious diseases using nonhuman primate models of human disease. Dr. Elizabeth S. Didier studies immune responses to microsporidia, pathogenesis, diagnostics and drug discovery for microsporidia infections, and works on the effect of gaining on host immune responses to infectious agents. Dr. James E. Miller studies the genetic basis for resistance to gastrointestinal nematodes.

The immunopathogenesis of pneumonia is a particular focus of the CEIDR. Dr. Samithamby Jeyaseelan studies molecular and cellular mechanisms responsible for neutrophil recruitment, priming and activation in bacteria-infected lungs, smoke-exposed lungs and smoke-exposure followed by infected lungs. Dr. Sanjay Batra studies the role of hematopoietic and/or resident cell-driven RIP2/NLR-mediated immune responses during bacterial pneumonia and in chronic obstructive pulmonary disease (COPD)/emphysema. The goal is to identify target pathways for better therapeutic intervention in individuals with bacterial pneumonia or COPD or at risk of developing COPD. Dr. Maria Antonieta Guerrero-Plata studies the immune response to respiratory syncytial virus and human metapneumovirus, the most important cause of lower respiratory tract infections in children, the elderly and immunocompromised patients. Dr. Deepak Kaushal and Dr. Smiriti Mehra study the molecular immunopathogenesis of Mycobacterium tuberculosis (TB) and TB/AIDS co-infections. These investigations are intended to elucidate individual regulatory genes that may play a crucial role in the adaptation and thus virulence of M. tuberculosis to the intracellular milieu, latency and reactivation.

Vaccine-Related Research

The CEIDR supports a robust vaccine development program with Dr. Chowdhury, developing live-attenuated bovine herpesvirus-1 (BHV-1) vaccines and using bovine herpesvirus-1 as a vector for vaccines against respiratory syncytial virus (RSV) and other viral pathogens of cattle. In concert, Dr. Vladimir Chouljenko studies the production of viral-vectored vaccines for West Nile, dengue and herpes simplex virus type-2. Dr. Vicki L. Traina-Dorge focuses on model development of viral infections in the non-human primate (NHP) and the use of these models to address viral pathogenesis, vaccine efficacy and antiviral therapies. Dr. Xiaolei Wang examines and compares the sequential development and functionality of both cellular and humoral immune systems in mucosal and systemic lymphoid tissues of NHP of different ages to predict immune responses of human infants at different stages of neonatal development. CEIDR faculty also study vaccines against nematode parasites. Dr. Thomas R. Klei is developing recombinant protein vaccines against filarial nematodes that infect humans. Dr. Chad Roy studies inhalation-acquired infectious diseases (including biothreat agents) using rodents, rabbits and NHP. He investigates the immunogenicity and protective efficacy of virally vectored vaccines against aerosol-initiated alphaviral disease.

Aquaculture Studies

Dr. Ronald L. Thune studies Edwardsiella ictaluri infection in channel catfish and Photobacterium damselae sub piscicida in hybrid striped bass. This work uses modern molecular genetic approaches to study pathogen host interactions, with an emphasis on bacterial pathogenesis and protective vaccine development. Dr. John Hawke studies the pathogenesis and vaccine development for photobacteriosis caused by P. damselae in hybrid striped bass; francisellosis caused by Francisella noatunensis in tilapia; and edwardsiellosis caused by Edwardsiella ictaluri in zebrafish.

It is anticipated that research outcomes will be translated into new diagnostics, vaccines and other treatment modalities for ameliorating human and animal infectious diseases.
**Impact**

Infectious diseases are among the most important causes of human death worldwide; they are responsible for more deaths annually than cancer. Also, infectious diseases cause high levels of morbidity and mortality in animals and a significant negative economic impact associated with human and animal health and animal food industry. Emerging infectious disease comprises those infectious diseases whose incidence has increased during the last two decades and threatens to increase in the near future. The rapid spread of infectious disease pathogens during epidemics and pandemics can produce severe economic and social disruption; hence the need for the development of therapeutic interventions through a proactive understanding of host-pathogen interactions. CEIDR work is geared toward the early diagnosis of emerging infectious diseases, production of efficacious vaccines for human and animal pathogens, and novel methodologies and drugs for the treatment of infectious diseases.

**An Unprecedented Opportunity**

The vision for the CEIDR is to establish a leading center in infectious diseases by identifying a critical nucleus and network of scientists with complementary interests in infectious disease research. The CEIDR will enhance and leverage available research resources and promote intra- and inter-institutional collaborative efforts on infectious diseases of far-reaching importance. This consortium of infectious disease scientists in south Louisiana will provide an unprecedented opportunity for research and training for all participating units. It is anticipated that research outcomes will be translated into new diagnostics, vaccines and other treatment modalities for ameliorating human and animal infectious diseases.

**For More Information**

To learn more about the CEIDR, please contact Dr. Konstantin “Gus” Kousoulas in the LSU SVM Department of Pathobiological Sciences at 225-578-9682 or vtgusk@lsu.edu, or by visiting our website at www.cobre.ceidr.lsu.edu.
Louisiana boasts a vibrant equine industry that contributes $2.8 billion to the state economy. The mission of the Equine Health Studies Program (EHSP) is to improve horse health in our state and region. The interdisciplinary and interdepartmental nature and interlaboratory collaborative efforts of the EHSP are strengths of the LSU School of Veterinary Medicine (SVM) community of scientists. Many faculty members throughout the EHSP, the SVM and LSU participate in EHSP-related research, mentor graduate students and post-doctoral students, and introduce veterinary students to opportunities for future careers in equine veterinary research.

Research conducted by the dedicated EHSP faculty and staff provides a deeper understanding into the causes, treatment and prevention of the most important diseases affecting horses. Only through a better understanding of equine diseases can we improve horse health and preserve Louisiana’s rich equine tradition. Central to the EHSP’s core research efforts is the Charles V. Cusimano Equine Physiology and Pharmacology Laboratory, where collaborative studies are conducted in vascular and nonvascular physiology and pharmacology relating to laminitis and airway diseases, gastrointestinal diseases, reproduction and pain management.

Gastrointestinal Diseases

Gastric Ulcers

In 2012, Dr. Frank Andrews and his research team focused on the use of feed supplements containing natural ingredients to treat and prevent stomach ulcers, a common horse ailment. The team found that adding a zinc supplement to the diet with omeprazole (an acid-blocking pharmacologic agent) may help prevent stomach ulcers. This information is especially important for horses fed twice daily and housed in stalls in a hot, humid climate.

Sea buckthorn berries (*Hippophae rhamnoides*) are rich in vitamins C and E, carotenoids, flavonoids, fatty acids, plant sterols, lignins and minerals. A study performed by Dr. Andrews’ team found that a feed supplement containing sea buckthorn berries and pulp (SeaBuck SBT Gastro-Plus liquid) showed effectiveness in the treatment of naturally occurring stomach ulcers in the lower part (glandular region).
of the horse stomach. Another study found that a supplement (SmartGut® Ultra) containing sea buckthorn berries and natural antacids prevented gastric ulcers from getting worse after omeprazole treatment and may be an affordable alternative to help guard against stomach ulcers, especially after omeprazole treatment is discontinued.

Colic

Colic is the leading cause of morbidity and mortality in horses. Diseases of the large intestine are a major cause of colic, causing varying degrees of debilitation, and death. EHSP researchers, including Dr. Rebecca McConnico, continue to work to determine the reasons behind large intestinal diseases and to look at associations between gastrointestinal disease and laminitis. Their goal is to find effective treatments that prevent or reduce damage from these life-threatening conditions.

Dr. McConnico’s research team is focused on cyclooxygenase inhibitors, such as phenylbutazone (bute), that are often used to treat arthritis and muscle pain in equine athletes worldwide. Although initially thought to be well-tolerated in horses, research shows that the drugs can cause adverse side-effects, including stomach and colon inflammation and ulceration and kidney dysfunction, even when given at recommended doses. Dr. McConnico’s team showed that prolonged phenylbutazone administration caused hypoalbuminemia, neutropenia, changes in colonic blood flow, and changes in volatile fatty acids. Based on this information, veterinarians should use these drugs with caution when treating horses.

Another pharmacologic study by Dr. McConnico’s team evaluated the safety of an oral paste formulation of a commercially available COX1-sparing NSAID, firocoxib (Equioxx®, Merial Limited, Duluth, Ga.) in clinically healthy 6-week-old pony foals. Results revealed that firocoxib administration did not have adverse effects on stomach, intestines or blood values and was well tolerated.

Musculoskeletal Diseases

Stem Cells as Treatment

Stem cells have evolved as a common treatment approach in veterinary medicine. “To develop stem cell therapies, we need to first optimize and describe their behavior in the laboratory to help us predict how they will behave in the body,” said Dr. Mandi Lopez. Dr. Lopez and her colleagues isolated multipotent stromal cells (immature stem cells in adult tissues) from equine bone marrow and fat. These stem cells participate in tissue maintenance and healing by maturing into adult cells as needed. Dr. Lopez’s team has successfully isolated and grown stem cells in the lab and focuses on uses of these cells in equine diseases.

Dr. Lopez and her colleagues also looked at the ability of multipotent stromal cells from bone and adipose tissue to produce bone, adipose and cartilage neotissue on pieces of collagen called a scaffold, which provides a framework for the cells to attach and produce tissue. The key finding of this study was that adult equine stem cells, when loaded onto collagen scaffolds, turned into fat, bone and cartilage. This is promising and may mean that stem cells may be used for tissue regeneration. “These findings support our ongoing efforts to develop equine stem cell tissue regeneration to provide new treatment options and improve upon existing ones,” said Dr. Lopez.

Laminitis

For the past 15 years, notable progress in understanding equine laminitis through research has been achieved under the direction of Dr. Susan Eades. As one of two recipients of a Grayson Jockey Club Research Foundation “Barbaro” Grant, Dr. Eades continues to evaluate treatment and prevention strategies for this devastating disease in horses. Laminitis can result in separation of the hoof layers, known as lamina, often resulting in rotation of the coffin bone (distal phalanx), an irreversible and deadly condition. Anecdotal observations and results of survey studies indicate that most laminitis cases occur in horses and ponies kept at pasture. Risk for development of pasture-associated laminitis results from high nonstructural carbohydrate content of the pasture grass and from animal-predisposing factors. Horses that have circulating concentrations of insulin (insulin resistance) are more likely to develop laminitis when grazing pasture grasses. Dr. Eades’ research team studies laminitis by infusion of insulin and glucose intravenously.
Another goal of Dr. Eades' team is to measure biomarkers in the blood during insulin-induced laminitis. A biomarker is a protein that is produced by the body in response to disease. Risk assessment by use of biomarkers is becoming increasingly common practice in both human and veterinary medicine; however, the use of biomarkers in equine laminitis has not yet been established. Dr. Eades' research team is evaluating the use of biomarkers in assessing the risk of laminitis occurrence in horses on pasture.

During laminitis, enzymes (metalloproteinases) that degrade the structures holding the hoof wall to the pedal bone are produced. Dr. Eades' team has shown that pentoxifylline is a potent inhibitor of these enzymes in the horse, and it effectively reduces lameness during laminitis. Another goal is to evaluate the effects of pentoxifylline on laminitis caused by insulin.

**Laminitis and Stem Cells**

Complex hoof structure and the complicated nature of laminitis make study and treatment of laminitis a challenging endeavor. Studies have shown that lamina tissue is irreversibly altered by laminitis, regardless of the cause of the inflammation. The presence of stem cells in the hoof is necessary for normal growth and healing. Based on this knowledge, Dr. Lopez and her colleagues theorized that the permanent changes in hoof wall structure from laminitis may be due to loss of or damage to the hoof stem cells. To investigate this theory, methods have been developed to isolate and grow stem cells from normal and laminitic hooves. Early results have confirmed that the isolated cells are capable of turning into several cell types, a characteristic of stem cells. This exciting discovery provides a new way to study and compare stem cells from normal hooves and those with naturally occurring laminitis. The possibilities to study causes, treatments and prevention of laminitis using this new laboratory model hold significant promise to improve the health and well-being of horses.

**Infectious Diseases**

**Rhinitis Virus**

Respiratory disease is common in race horses. The economic impact of viral-induced infectious respiratory disease, such as Equine Influenza virus and Equine Herpes virus, on the horse industry is substantial. Despite this, little is known about Equine Rhinitis Virus (serotypes ERV-1 and ERV-2) in racehorses housed and trained in Louisiana. Dr. Andrews' research team conducted a study to determine seroprevalence of ERV in horses at a racetrack, training center and university farm in southern Louisiana. The study revealed that ERV-1 and ERV-2 were present, and ERV-1 was more prevalent in horses housed at the race track and the university farm compared with the training facility. The difference in prevalence at these facilities may be due to age, as horses at the racetrack and university farm were older, allowing more time for virus exposure. ERV appears to be prevalent in horses in Louisiana and warrants further epidemiologic investigation to determine its impact on racing and training and the need for vaccine development to reduce its impact.

**Equine Herpes Virus**

Through joint efforts with private practitioners, the state veterinarian's office and the Louisiana Disease Diagnostic Laboratory, EHSP researchers (Drs. Andrews, Eades, McConnico and Roy) continue to report on the management of Equine Herpesvirus Type 1 infections in Louisiana and the region. The team, along with colleagues from other universities, has reported on outbreak scenarios and the importance of minimizing economic losses, while protecting the health and welfare of horses by encouraging equine veterinarians and regulatory officials to agree on nomenclature, case definition, interpretation of molecular diagnostic tests, and appropriate biosecurity responses.

**Respiratory Diseases**

Recurrent airway obstruction (RAO) is a debilitating respiratory disorder in horses, similar to human asthma. Dr. Changaram Venugopal is focused on airway hyperreactivity and is characterizing and identifying inflammatory mediators of diseases. Dr. Venugopal’s team is focused on inflammatory mediators in Summer Pasture Associated Obstructive Pulmonary Disease, which is common in Louisiana. These mediators are responsible for the contraction of airway smooth muscles, increased vascular permeability leading to edema, increased mucus secretion, and damage to airway epithelium.

In recent years, Dr. Venugopal and his colleagues have examined alterations in tissue receptors of two important mediators, endothelin and neurokinin-A, during their transformation from a healthy state to a disease state. The findings of the investigation of novel antagonists of these receptors, particularly endothelin B-receptor antagonists for endothelin and NK-2 receptor antagonists for neurokinin, suggested their potential use in RAO in horses.
Currently, Dr. Venugopal and his team are working to find a vaccine for RAO. Their emphasis is on the unique role of endogenous anti-inflammatory proteins (Secretoglobulin family) produced by Clara cells in the airways. These proteins are believed to block inflammation, which is the primary cause of airway injury and leaves the airways vulnerable to attack by allergens. Dr. Venugopal and his collaborator, Dr. Sudhirdas K. Prayaga, an immunologist with the Antibody Research Corporation, were able to identify and develop a peptide (patent pending) that could produce antibodies to protect animals from seasonal allergy. Dr. Venugopal's team is planning to investigate whether a subcutaneous-administered peptide will prevent RAO in horses.

**Theriogenology (Reproduction)**

Theriogenology research includes stallion and mare reproduction. Dr. Sara Lyle and her research team have investigated the response of the immune system and the fetal endocrine system in response to bacteria that lead to abortion in the mare. Most notable was the discovery that inflammation post-infection precociously matures the fetal hypothalamic-pituitary-adrenal axis (responsible for the production of cortisol, a key hormone in response to stress). These findings explain in part why foals that survive following delivery subsequent to placentitis are more mature than foals delivered prematurely due to other reasons.

Dr. Lyle’s other investigations focus on changes in uterine pressure to endotoxemia and to stallion vocalization; these investigations use the SmartPill® system (a device that measures gastrointestinal pressure in people). Understanding how endotoxemia can lead to abortion will help refine treatments aimed at maintaining pregnancy following colic. The response to stallion vocalization may lead to improved methods of managing mares that cannot effectively clear the uterus of fluid and debris after mating.

Another area of research involves the use of third generation buffered chelators as adjunctive therapy for mares infected with bacteria or yeast. Chelators are helpful when these microbes become resistant to traditional antibiotics and antifungal agents, and in cases where biofilm (a micro-colony of bacteria/yeast that are attached to the lining of the uterus) is suspected.

Several other studies have focused on optimizing semen processing for either fresh-cooled shipment or “freezing” of stallion semen. Dr. Lyle’s group has found that higher centrifugal forces than traditionally used are safe, and that cushion media do not substantially improve spermatozoal characteristics for shipped fresh-cooled semen but may provide some beneficial effects when processing semen for freezing.
The Department of Pathobiological Sciences has a strong vector-borne disease research program that investigates diseases carried and transmitted by insects or other arthropods such as ticks. These diseases can be viral, bacterial or parasitic, and can affect both humans and animals. All of these studies are funded by significant extramural research grants and contracts from the National Institutes of Health (NIH) and the USDA.

**Lyme Disease**

Dr. Fang-Ting Liang is working on *Borrelia burgdorferi*, the tick-borne bacterium that causes Lyme disease. In humans, the first sign of infection is usually a characteristic “bull’s-eye” rash surrounding a tick bite; untreated, it can spread to other parts of the body and cause neurological disorders and severe arthritis. Lyme is the most common vector-borne human disease in much of the northern hemisphere (nearly 30,000 people contracted the disease in 2008 in the U.S. alone).

The Lyme disease organism has an unusual ability to defeat the body’s natural immune response and set up infection, and Dr. Liang’s research focuses on the means by which this occurs. “Developing a specific antibody response is an effective way for the host to eliminate bacterial infection, but *B. burgdorferi* can change its surface antigenic architecture,” he said. “This is a powerful strategy the bacterium uses to avoid elimination by specific antibodies and cause persistent infection. Our goal is to understand how this happens, which we hope will lead to better treatment and prevention options.”

**Rickettsia**

Dr. Juan J. Martinez is working on a group of obligate intracellular, Gram-negative α-proteobacteria of the genus Rickettsia with a specific interest in members of the Spotted Fever Group (SFG) including *R. rickettsii* (Rocky Mountain Spotted Fever), *R. conorii* (Mediterranean Spotted Fever) and *R. australis*.

The pathogenesis SFG Rickettsia, upon transmission into the host, depends on the pathogen’s ability to bind to and invade target host cells. Although endothelial cells are the primary target cells in the host, many non-endothelial cell lines can also be efficiently invaded by rickettsial strains, suggesting that either multiple receptors govern host cell interactions or that a putative receptor is ubiquitously expressed in many cell types. Analysis of several completed rickettsial genomes has revealed the presence of at least 17 open reading frames, termed surface cell antigens (Sca), whose putative products exhibit high homology to auto-transporter protein families in Gram-
negative bacteria. Five members of this family, Sca0, Sca1, Sca2, Sca4 and Sca5, are highly conserved among most pathogenic SFG Rickettsia. Interestingly, rOmpA (Sca0) and rOmpB (Sca5) have both been shown to be involved in rickettsial adherence and invasion into normally non-phagocytic mammalian cells; however, very little is known about the function of other conserved Sca proteins in pathogenesis. Research is focused on addressing the following interests:

a) Elucidation of the roles of conserved Sca proteins in the interaction with endothelial cells;

b) Identification of mammalian receptors for SFG rickettsiae;

c) Generation of protective humoral immune responses against SFG rickettsiae using established murine models of infection.

“Understanding how some of these conserved proteins bind to target cells at a molecular level will hopefully lead to the development of novel compounds that can inhibit this process,” Dr. Martinez said. “Furthermore, we can utilize purified Sca proteins as potent immunogens to develop specific antibody responses that can then help to inhibit the establishment of productive rickettsial infections in animals and humans.”

**West Nile Virus**

Dr. Alma Roy works with the West Nile virus (WNV), which is transmitted from reservoir species of birds to humans, horses and other animals via mosquito bites.

WNV appeared in North America in 1999 and quickly spread across the continent. Each year thousands of horses in the United States are infected with the virus. There are several commercial vaccines available for horses to help prevent disease. Dr. Roy’s research involves working with others at the School of Veterinary Medicine (SVM) to create a vaccine that would produce specific humoral immune responses against WNV that would be capable of neutralizing the virus and preventing disease in horses. Research is being conducted to design a recombinant protein vaccine to be used in horses.

Dr. Roy’s lab also performs environmental surveillance for Louisiana that monitors local WNV activity in vectors and non-human vertebrae hosts in advance of epidemic activity affecting humans. Involvement in environmental surveillance provides an opportunity for detection of the current strain of virus, which can be used for vaccine development. “The knowledge we have gained through surveillance is helping us understand the epidemiology of West Nile virus and providing West Nile virus strains for research,” Dr. Roy said.

**Dengue Virus**

Dr. Christopher Mores’ research is on arthropod-borne viruses (arboviruses). Having studied the transmission and emergence of many zoonotic arboviruses, he now focuses on dengue virus. Transmitted by mosquitoes, dengue causes millions of human infections each year in tropical and subtropical regions. Typically a relatively mild febrile illness, more severe manifestations such as dengue hemorrhagic fever or dengue shock syndrome are being seen. Outbreaks of severe disease seem to coincide with periods in which multiple serotypes of the virus circulate in nature.
Dr. Mores investigates the role of competitive effects between co-circulating serotypes of dengue virus in this emerging public health threat. “By better estimating the critical parameters of dengue virus transmission and understanding the relationships and behaviors of those parameters to one another,” Dr. Mores said, “we will be able to devise better surveillance efforts, better plan vaccine trials, and support enhanced policies and procedures for control of disease outbreaks.”

**Rocky Mountain Spotted Fever**

Dr. Kevin Macaluso studies the transmission of flea- and tick-borne bacterial pathogens, particularly the agents of emerging flea-borne rickettsiosis, *Rickettsia felis*, and Rocky Mountain spotted fever (RMSF), *Rickettsia rickettsii*, respectively.

Dr. Macaluso’s research explores the mechanisms of transmission of rickettsiae by arthropod vectors, specifically the transmission of *R. rickettsii* from the tick to the vertebrate host and the contributing factors that allow certain rickettsiae to be transmitted only by certain tick species. Although several species of ticks all live in the same geographic area where RMSF occurs, typically only ticks of the genus *Dermacentor* can transmit these organisms to humans, and Dr. Macaluso wants to find out why and how this happens.

“We believe the factors that control the transmission are tick-derived instead of being controlled by some bacterial component, so that when we discover the means that allow only specific ticks to transmit the infection, we will be able to devise a means to more effectively prevent RMSF,” he said. Dr. Macaluso’s research activities are supported by extramural funding totaling $2.4 million from the NIH, National Institute of Allergy and Infectious Diseases.

**Human Onchocerciasis/Lymphatic Filariasis**

Dr. Thomas Klei has developed the animal model for the study of lymphatic filariasis using *Aedes aegypti* mosquitoes, the filarial nematode *Brugia malayi* and Mongolian gerbils. During the past 35 years, he has used this system in studies of the pathogenesis and immunology of this human tropical disease. His laboratory is currently teamed with three other U.S. laboratories funded by a $5 million NIH grant with the objective of developing a recombinant protein vaccine against the nematode parasite *Onchocerca volvulus*. This group was recently joined by scientists from the United Kingdom and Germany. The Brugia model is one of three animal models being used as part of this effort.

Onchocerca, the causative agent of “river blindness,” is found predominantly in west Africa and is considered a major neglected tropical disease. River blindness is caused by the filarial nematode parasite *Onchocerca volvulus* (Ov) and is transmitted by black flies.

The overall goal of the research group is to develop a vaccine against human onchocerciasis, targeting the Ov larvae, which are known to be vulnerable to attack by the host’s immune system. The team hopes to identify two to three recombinant protein antigens with the highest probability for success at reducing or potentially eliminating infection, disease and transmission. “Onchocerciasis has received minimal research funding for many years,” said Dr. Klei, “but with over 37 million cases of onchocerciasis occurring worldwide and some 120 million people being at risk, it’s a real problem that needs addressing. If successful, our approach will add to the control of this devastating infection.”

Vector-borne diseases have long had a significant impact on the health of humans and animals worldwide. LSU SVM researchers’ common goal is to improve human lives and livelihoods, both in Louisiana and throughout the world.
**Awards**

Zoetis (formerly Pfizer Animal Health) presents the Zoetis Award for Research Excellence, consisting of an honorarium and an inscribed plaque, to a faculty member who has excelled in veterinary medical research during the past two years.

The LSU School of Veterinary Medicine Faculty Distinguished Scholar Award, which consists of an honorarium and an inscribed plaque, is presented to a faculty member who has made significant contributions to the advancement of veterinary medicine through research and/or scholarly activities. Each year, the LSU SVM also bestows the School of Veterinary Medicine Distinguished Dissertation Award and the School of Veterinary Medicine Distinguished Thesis Award, which consist of honoraria and plaques.

**2014**

Dr. Charles Lee received the Zoetis Award for Research Excellence.

Dr. Christopher Mores received the SVM Faculty Distinguished Scholar Award.

Balamayoonan Theivanthiran, PhD (LSU SVM 2013), received the SVM Distinguished Dissertation Award. He received his PhD in May 2013 from the Department of Pathobiological Sciences. His dissertation was entitled “Role of NOD2/RIP2 Signaling in Acute Bacterial Pneumonia and Sepsis.” Dr. Theivanthiran’s major adviser was Dr. Samithamby Jeyaseelan. He is currently a postdoctoral fellow in the Baylor Institute for Immunology Research in Dallas, Texas.

Allyson Moscona, BS, MS, received the SVM Distinguished Thesis Award. She received her MS degree from the Department of Pathobiological Sciences in August 2013. Her thesis was entitled “Copper Oxide Wire Particles Used to Control Haemonchus Infections: Efficacy in Giraffe (Giraffa Camelopardalis) at Busch Gardens Tampa and Potential Mechanism of Action,” and her major adviser was Dr. James Miller.

**2013**

Dr. Mandi Lopez received the Zoetis Award for Research Excellence.

Dr. Samithamby Jeyaseelan received the SVM Faculty Distinguished Scholar Award.

Dr. Britton Grasperge received the SVM Distinguished Dissertation Award. His dissertation was entitled “Development and Characterization of a Murine Model of Rickettsia parkeri Rickettsiosia,” and his major advisor was Dr. Kevin Macaluso. Dr. Grasperge is currently an assistant professor in PBS.

Florence Polle, DVM, MS (LSU SVM 2012), received the SVM Distinguished Thesis Award. Her thesis was entitled “Role of Intracocular Leptospira Infections in the Pathogenesis of Equine Recurrent Uveitis in the Southern United States,” and her major advisor was Dr. Renee Carter. Dr. Polle is working in a private veterinary practice in Normandy, France.

**2012**

Dr. Christopher Mores received the Pfizer Animal Health (now Zoetis) Award for Research Excellence.

Dr. Susan C. Eades received the SVM Faculty Distinguished Scholar Award.

Jeffrey Cardinale, PhD (LSU SVM 2011), received the SVM Distinguished Dissertation Award. He received his PhD in August 2011 from the Department of Comparative Biomedical Sciences, and his dissertation was entitled “The Role of Inflammatory Molecules in Hypertension.” His major adviser was Dr. Joseph Francis, and he is enrolled in medical school at the LSU Health Sciences Center.

Sayble Sprinkle received the SVM Distinguished Thesis Award. She received her MS degree from VCS in August 2011, and her thesis was entitled “Biomechanical Evaluation of Medial and Lateral Approaches for Experimentally Created Medial Condylar Fractures of the Equine Third Metacarpal Bone.” Her major advisors were Drs. Laura Riggs and Gary Sod. Sprinkle is enrolled in veterinary school in Australia.

**2011**

Dr. Samithamby Jeyaseelan received the Pfizer Animal Health (now Zoetis) Award for Research Excellence.

Dr. Thomas Tully, Jr., received the SVM Faculty Distinguished Scholar Award.

Jeffry John Cutrera, PhD (LSU SVM 2010), received the SVM Distinguished Dissertation Award. His dissertation was entitled “Identification of a Tumor-Targeting-Peptide and Development of a Tumor-Targeted-Cytokine Vector for Systematic Treatment of Primary and Metastatic Malignancies,” and his major advisor was Dr. Shulin Li. Dr. Cutrera continued his research at M.D. Anderson Cancer Center in Houston, Texas.

Piper Lynn Nelson, MS (LSU SVM 2010), received the SVM Distinguished Thesis Award. Her thesis was entitled “Depolarization by Transient Receptor Potential Melastatin 4 in Pancreatic Alpha-Cells Regulates Glucagon Secretion.” Her major advisors were Drs. Henrique Cheng and Ji-Ming Feng.
Dr. Christopher Mores received an award from the National Institutes of Health (NIH), National Institute of General Medical Sciences (NIGMS), to join the group Models of Infectious Disease Agent Study (MIDAS). This research network uses computational modeling techniques to better understand the spread of contagious diseases and to calculate the potential impact of public health measures.

Dr. Mores is the principal investigator of a project entitled “Predicting Vector-Borne Virus Transmission and Emergence Potential.” The award will provide more than $3 million for five years for Dr. Mores and his consortium of researchers from LSU, Tulane University and the University of New Mexico to investigate and predict the transmission and potential for emergence of various arthropod-borne viruses (or arboviruses), particularly dengue.

Dengue, an arbovirus transmitted by mosquitoes, primarily *Aedes aegypti*, is one of the few arboviruses that almost exclusively affects humans, causing over 50 million cases annually. Dengue historically has been a tropical disease, but international travel has facilitated its expansion into other parts of the world.

Dengue can cause high fever, chills, headache, pain behind the eyes, rash, mild bleeding of the nose or gums, and excruciating joint and muscle pain (hence the common name of “break-bone fever”). Since dengue is caused by a virus, there is no specific treatment. While this traditional form of disease is very painful and convalescence is slow, most patients recover fully.

However, more serious manifestations called dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS) appeared in the mid-20th century. The symptoms of DHF and DSS are the same as the typical form of the disease at first, but as the initial fever declines, the patient starts vomiting and develops abdominal pain and difficulty in breathing. Skin hemorrhages, bleeding nose and gums, and internal bleeding may also occur, and capillaries become “leaky,” allowing plasma (the fluid component of blood) to seep from the vessels into the body cavity. This may lead to circulatory system failure, shock and death if not recognized early and treated properly. Incidence of these severe forms of dengue is increasing. There are four serotypes, or strains, of the dengue virus, but infection with one serotype does not confer immunity to the others.
and some data indicate that infection with a second serotype puts individuals at higher risk for these severe disease forms.

"Dengue is spreading into the southern and southwestern United States," said Dr. Mores. "Most of the dengue cases detected in the U.S. are imported, but the number of locally acquired cases is increasing. The entire Gulf Coast is at potential risk from dengue," he said. "Our borders are constantly being challenged by this introduced virus—it is being brought in by travelers and becoming established in local mosquito populations. Since 2009, we've seen local transmission of dengue in the U.S. when people vacationing in Key West became infected after being bitten by local mosquitoes. Furthermore, in 2010, Puerto Rico witnessed an extensive outbreak with over 10,000 cases reported. The vector density needed to achieve transmission is very low, so it doesn't take many infected mosquitoes to trigger an outbreak."

The aim of Dr. Mores' project is to use mathematical modeling to more accurately forecast the transmission of dengue and other viral diseases, particularly in the U.S. Of particular interest are the specific factors that affect transmission in the vector and human populations separately, and then how these factors combine to affect overall transmission of the virus.

"A problem with predicting the potential for emergence and spread of these viral diseases," said Dr. Mores, "has been that often the data from field and clinical research don't get into the hands of the people doing the mathematical modeling. We've seen that the researchers making the applied discoveries and the modelers working on the theoretical end sometimes don't communicate well with each other because they don't speak the same technical language. And when people doing the modeling don't have all the data they need, they must make assumptions, and sometimes those assumptions aren't as accurate as they could be."

The work planned by Dr. Mores' consortium is expected to provide improved forecasting of outbreaks of dengue and other arboviruses, predicting them before they begin or detecting them while still in the early stages, and to help the public health community get an accurate estimate of the scope of a burgeoning outbreak to better guide responses.

"We intend to look at the whole system of vector-borne viral diseases to help us get a better estimate of the transmission and emergence potential of these viruses through incorporation of clinical, field and experimental data into theoretical models," said Dr. Mores. "We will also be looking at other mosquito-borne viruses, such as chikungunya and Rift Valley fever, which also have the potential to expand into the southern U.S. via infected travelers, animals and vectors, and become entrenched in local mosquito populations."

"Dr. Mores has assembled a diverse and talented team to study the spread of insect-borne diseases, like dengue fever, which threaten to emerge in the U.S.," said James Anderson, PhD, who helps manage the MIDAS program at the NIH. "The team will first concentrate on establishing the factors that drive the spread of dengue and assessing the impact of community-based and international intervention strategies. They will then seek to apply their findings to modeling the spread of other insect-borne diseases, an approach that will nicely complement the other projects in the MIDAS consortium."

Following the resurgence of West Nile virus (WNV) activity during the 2012 transmission season, Dr. Mores' MIDAS consortium was asked to respond to the threat by evaluating the virological and ecological conditions that may have led to the outbreak. Partnering with the Louisiana Animal Disease Diagnostic Laboratory, the Centers for Disease Prevention and Control, the National Oceanic and Atmospheric Association, numerous parish mosquito abatement organizations and other academic collaborators, Dr. Mores' group is developing a tiered WNV threat model that can provide advanced warning of pre-outbreak conditions and near-outbreak response guidance.

Other advances from the group's activities include development of a dengue mosquito risk map (based on New Orleans data), shedding light on the dynamic role of human infectiousness (with dengue) to mosquitoes, understanding how daily human activities influence the chance of mosquito and virus exposure, and evaluating the impact of faster-spreading viruses upon epidemics and control efficacy.
Seven faculty members at the LSU SVM are investigating respiratory diseases. Six are focusing on diseases affecting humans and one is conducting research on respiratory disease in cattle. While the studies of this cluster of scientists seem diverse, the basic knowledge gained on the pulmonary systems response to various stressors and their laboratories’ interactions will benefit advances in treatment and control of a variety of human and animal pulmonary disease conditions. Their combined research is supported by more than $8 million in grant funds.

Respiratory disease research is being conducted in the Departments of Comparative Biomedical Sciences and Pathobiological Sciences.

**Air Pollutants**

Dr. Arthur Penn is studying respiratory system responses to major combustion-related air pollution events (oil refinery/pipeline explosions and fires, industrial accidents and forest fires). A long-term focus of his laboratory has been the involvement of environmental stress in adult chronic disease, especially atherosclerosis and asthma. The main environmental stressor studied is second-hand cigarette smoke. Recently, Dr. Penn has been investigating the relationship between in utero exposure to second-hand smoke (i.e., exposure of pregnant mice to second-hand smoke) and the subsequent development of atherosclerosis or asthma in the adult offspring, which are never exposed to smoke after birth. Dr. Penn’s published results show that even in the absence of a high-fat diet, in utero exposure to second-hand smoke results in significantly accelerated atherosclerosis, which is associated with increased oxidative stress, and in utero exposure to second-hand smoke aggravates adult responses to agents that provoke asthmatic responses.

**Smoke-Induced Diseases**

Dr. Sanjay Batra is investigating smoke-induced diseases to understand the molecular and cellular mechanisms involved in regulating innate immune responses during bacterial pneumonia, Chronic Obstructive Pulmonary Disease (COPD) and emphysema. His research is supported by a $370,000 grant from the National Institutes of Health and a $325,000 grant from the Flight Attendant Medical Research Institute. Dr. Batra’s overall goal while working with the Lung Biology Group is to investigate the role of intracellular pattern recognition receptors (NOD-like receptors) during pulmonary bacterial infection, COPD and emphysema. His preliminary work has identified the significant role of membranes (lipid rafts), tyrosine phosphorylation, and ubiquitination in regulating receptor interacting protein and NLR-mediated immune responses. Understanding these mechanisms in detail may provide novel insights to identify new therapeutic targets that may be important in regulating neutrophil recruitment and their function in the lung during various pathological conditions.
**Bovine Herpesvirus**

Dr. Shafiqul Chowdhury is investigating molecular virology and recombinant vaccine technology of bovine herpesviruses (BHV). Bovine herpesvirus type 1 (BHV-1) is an important viral pathogen of cattle that can cause severe respiratory tract infection known as infectious bovine rhinotracheitis (IBR), and abortion in pregnant cows, and is an important component of the Bovine Respiratory Disease Complex (BRD, “Shipping fever”). BRD is known to cost the U.S. cattle industry at least $500 million annually. IBR also causes a substantial drop in milk and meat production in cattle. The long-term goal of Dr. Chowdhury’s lab is to understand how BHV-1 and BHV-5 spread within the nervous system and the role of envelope glycoproteins in the regulation of pathogenicity and immunogenicity of BHV-1.

**Bacterial Pneumonia**

Dr. Samithamby Jeyaseelan studies neutrophil recruitment, the most important initial host innate immune mechanism against bacteria, which is how the immune system eliminates bacteria at the site where disease-causing microbes enter the body. The overall goal of Dr. Jeyaseelan’s research is to understand the molecular and cellular mechanisms responsible for neutrophil recruitment, priming and activation in the lungs. “The challenge in the next decade will be to develop novel approaches to keep neutrophils in the lung for defensive functions while modulating their undesirable effects leading to extensive lung damage,” said Dr. Jeyaseelan. New therapeutic strategies are extremely important since 1) bacterial pneumonia affects more than one million adults, with 30,000 deaths per year in the U.S. alone; 2) neutrophil influx associated with bacterial pneumonia is the killer in several viral outbreaks, including flu; and 3) cigarette smoking and alcohol consumption are the two strongest risk factors for pneumonia in healthy young people.

**Respiratory Viruses**

Dr. M. Antonieta Guerrero-Plata is researching innate immunity, dendritic cells, and the effect of environmental factors on the pathogenesis of respiratory viruses. Her current projects are in the field of viral immunology, because understanding the mechanistic aspects of the immune response to viruses is fundamental to manipulate host responses, improve antiviral immunity, or prevent severe disease caused by viral infections. Dr. Guerrero-Plata works with respiratory viral pathogens that are the most important cause of lower respiratory tract infections in children, the elderly and immunocompromised patients (respiratory syncytial virus and human metapneumovirus). The immunity induced by these viruses is not fully protective, and of short duration. Further, reinfections are common throughout life. Therefore, one of her projects seeks to determine the mechanisms used by these viruses to alter the immune response of infected individuals. Another project focuses on understanding the mechanisms underlying the severity and frequency of respiratory viral infections in children exposed to environmental tobacco smoke.

**Cigarette Smoke and Bacterial Virulence**

Dr. Ritwij Kulkarni studies the effects of cigarette smoke exposure on the virulence of bacterial pathogens that cause respiratory tract infections. The human body is home to billions of bacteria that inhabit mucosal spaces as constituents of normal microflora. “What is interesting is that many respiratory pathogenic bacteria such as
Staphylococcus aureus, Streptococcus pneumoniae and Haemophilus influenzae are present in the normal microflora of upper respiratory tract mucosal neutrophil recruitment,” said Dr. Kulkarni. “The microflora are bound to experience ‘our’ exposures to environmental irritants such as cigarette smoke. We hypothesize that the exposure to genotoxic chemicals in cigarette smoke will lead to the emergence of respiratory pathogens that are more virulent and exhibit increased antibiotic resistance. We have already established that oxidant chemicals in cigarette smoke induce biofilm formation by Staphylococcus aureus by downregulating a quorum sensing regulon ‘agr.’ Now we are applying a high throughput transcriptome analysis approach, RNAseq, to identify cigarette smoke-mediated alterations in gene expression,” he said.

Tuberculosis

Dr. Smriti Mehra is responsible for developing her independent research program in tuberculosis (TB). TB remains an enormous public health problem because the bacterium (Mycobacterium tuberculosis; Mtb) has evolved to evade removal by our immunity. Multidrug resistant (MDR), extensively drug-resistant (XDR), and possibly totally drug-resistant (TDR) strains of Mtb are an emerging problem. Dr. Mehra holds positions in Pathobiological Sciences at the LSU SVM and in the Division of Microbiology at the Tulane National Primate Research Center. She employs a nonhuman primate model of TB in rhesus macaques via infecting Mtb aerosols. Her research interests are: 1) to evaluate potential novel vaccines for their safety and efficacy; 2) to study the role of host negative regulators of T cell function; and 3) to test the safety and efficacy of recombinant/attenuated Bacille Calmette–Guerin strains as part of prime-boost vaccines against Mtb infection.

Immunity Against Respiratory Bacteria

Dr. Shanshan Cai is studying the innate immune response (the first line of defense against pathogens) against bacteria (Klebsiella and Legionella). These bacteria are highly pathogenic and cause pneumonia in both adults and children. Another research avenue is to investigate the role of inflammasomes in second-hand smoke-induced inflammation using mouse models and human samples with regard to COPD. Dr. Cai received an initial $325,000 award for three years to investigate COPD from the Flight Attendant Medical Research Institute (FAMRI). Overall, Dr. Cai’s studies are to understand the molecular and cellular events that lead to pneumonia and COPD, which are crucial to designing better therapeutic strategies for individuals whose lungs have been affected by these devastating diseases.
Summer Scholars Program

Each year, the LSU SVM selects students for its Summer Scholars Program, which provides veterinary students with an introduction to biomedical research. This competitive program encourages innovative studies in human and animal diseases and leads to further understanding toward veterinary careers in biomedical research. The research projects are funded by outside organizations or LSU SVM departments. Merial has funded the LSU SVM Summer Scholars Program since 2002, and the National Institutes of Health (NIH) has provided funding since 2004 through a T35 grant. Funding has also been provided by the Morris Animal Foundation, the Kenneth F. Burns Trust, the LSU SVM Equine Health Studies Program and the American Humane Society.

Elected students receive a stipend and present their research findings at a symposium at a U.S. veterinary school. The symposium brings together scientists from academia, the pharmaceutical industry and NIH leadership. Some students present their research findings at other university symposia, such as the LSU SVM’s Phi Zeta Research Emphasis Day.

In 2013, the NIH award that supports a portion of the SVM Summer Scholars Program was extended for another five years. The long-term objective of this program continues to be to attract veterinarians to careers in biomedical research. Our graduates are tracked to assess the long-term outcome of the program. Since the initiation of this award nine years ago, the T35 grant has supported the training of 72 pre-doctoral veterinary students. Of these, 18 scholars are still currently enrolled in the professional program (earning a DVM); of the remaining 54 trainees who have graduated with a DVM, 24 (44.4 percent) have continued in a research-oriented career path in industry or academia.

Phi Zeta Research Emphasis Day

The LSU SVM holds its annual Phi Zeta Research Emphasis Day in September. Phi Zeta is the national veterinary honor society that recognizes and furthers scholarship and research in matters pertaining to the welfare and diseases of animals. The Phi Zeta Research Emphasis Day recognizes research conducted by veterinary students, interns and residents, graduate students and faculty, and highlights the many career paths available in veterinary medicine. The importance of this day to the SVM is underlined by the fact that the Veterinary Teaching Hospital is closed except for emergencies to allow all students and house officers to participate.

Phi Zeta Day provides an opportunity for national experts to speak to students on current research in various fields and to present a picture of global veterinary research. Students (including interns and residents), faculty and staff present current biomedical research in poster format. A student poster competition is held with three categories: 1) doctoral; 2) basic research (undergraduates, Master’s students, and interns and residents); and 3) clinical research (undergraduates, Master’s students, and interns and residents).

Past Summer Scholars and Phi Zeta award recipients of note include Jessica Trichel, DVM (LSU SVM 2012), and Britton Grasperge, DVM (LSU SVM 2006), PhD (LSU SVM 2012), DACVP. Dr. Trichel received first place twice in the Clinical Research student competition; in 2009, she was awarded first place for her project entitled “Magnetic Resonance Imaging of the Equine Temporomandibular Articulation-A Comparative Morphological Study,” and in 2010 for her project entitled “Magnetic Resonance Imaging in Foals with Septic Arthritis.” Dr. Grasperge received first place in the PhD category in 2011 for his project entitled “Susceptibility of Inbred Mice to Spotted Fever Group Rickettsia parkeri.” Dr. Grasperge completed his clinical pathology residency at the LSU SVM and is currently on our faculty as an assistant professor.
Research done at veterinary medical schools used to be limited to investigating diseases and abnormal conditions of animals, but those days are long past. Today, veterinary schools are at the forefront of ground-breaking advances that benefit not only companion or farm animals but also humans. Much of this research is being done on a molecular level.

**Prostate Cancer**

Dr. Inder Sehgal investigates the mechanism and therapies for human prostate cancer metastasis. He has been focused on the role of the urokinase receptor on promoting successful metastasis and is trying to define, through both in vitro studies and use of a mouse model, how this happens.

From a more therapeutic standpoint, in collaboration with Dr. Konstantin “Gus” Kousoulas, Dr. Sehgal has shown that some of Dr. Kousoulas’ oncolytic herpes viruses are very effective in killing proliferating prostate cancer cells in mice. He plans to expand this research to use the death of primary cancer cells as a means of inducing immunologic memory to inhibit metastases. His research is supported by a National Institutes of Health (NIH) R15 grant.
Diabetes

Dr. Henrique Cheng received his veterinary degree from the Faculdade de Ciências Agrárias do Pará in Brazil. He received his MS degree in 1997 and his PhD in 2002, both from Iowa State University. Dr. Cheng’s research focuses on the molecular mechanisms controlling stem cell differentiation for tissue regeneration. Another area of research is the control of pancreatic hormone secretion and its impact on diabetes.

Effects of Alcohol

Dr. Masami Yoshimura received his BSc in 1979, his MSc in 1981 and his DSc in 1984, all from Kyoto University in Japan. He is studying the effects of alcohol on signal transduction pathways of cyclic adenosine monophosphate, a molecule that regulates various metabolic processes, including sugar and lipid metabolism, cell growth and differentiation, cardiac function, olfaction, and learning and memory; it also mediates the effects of many hormones at the cellular level. Dr. Yoshimura currently has an NIH grant.

DNA Repair

Dr. Shisheng Li received his MS in 1988 from Nankai University in China and his PhD from the University of Wales in 1997. He is researching the mechanisms by which the body can repair DNA damage. Cellular DNA damage can be caused by a number of factors, both external and internal, and this damage is believed to be linked to tissue damage, aging, autoimmune diseases and many forms of cancer. Damage can occur when endogenous cellular processes form free radicals and other mutagens as normal metabolic byproducts. To minimize the effects of such damage, cells have evolved several mechanisms to repair their DNA, and two of these mechanisms are the subject of Dr. Li’s research. Dr. Li and his group focus on the mechanisms of nucleotide excision repair and base excision repair, using a yeast (Saccharomyces cerevisiae) model. “We use the yeast model,” Dr. Li said, “because it is simple, easy to manipulate, and the repair mechanisms are very similar to those of humans.” Dr. Li’s research is supported by grants from the NIH and the National Science Foundation.

Autoimmune Diseases

Dr. Ji-Ming Feng received his MS in 1994 and his PhD in 1994, both from Beijing Medical University in China and was an assistant research neuroimmunologist at the UCLA School of Medicine. Dr. Feng is interested in the molecular regulation of calcium signaling in T-cells and the role of the pathways in autoimmune diseases, especially multiple sclerosis (MS), an autoimmune-mediated demyelination disease in humans. In addition, his research seeks to identify the molecular mechanisms of lymphoma formation. Dr. Feng’s research is funded by the National Multiple Sclerosis Society.

Auditory System

Dr. Charles Lee received his PhD in 2004 from the University of California at Berkley. He is studying the neural mechanisms responsible for encoding and processing of sensory information in the brain, with a focus on the central auditory system. His research integrates molecular and circuit-level analyses in order to derive the neurobiological principles governing normal behavior and the causes of neurological disorders, such as epilepsy, schizophrenia and autism. The projects in his laboratory are currently supported by grants from the NIH, the Louisiana Board of Regents and the Simons Foundation Autism Research Initiative.

Bone and Joint Pathology

Dr. Margaret McNulty received her BS from Colorado State University in 2005 and her PhD from the University of Minnesota in 2010. Dr. McNulty’s research focuses on bone and joint pathology and methods of improving diseases affecting both organs. Her research could eventually have great impact on human health (see page 38).
Creating Vaccines

Many steps are required before a vaccine can be introduced for clinical use. Quite apart from the often-enormous task of producing and testing a vaccine, new vaccines are typically first patented, the patent is licensed by a pharmaceutical company, and the vaccine is tested to USDA standards prior to eventual marketing and distribution. Researchers at the LSU SVM have filed three patents for vaccines through the LSU Office of Intellectual Property that will have a profound impact on our world.

Bovine Herpes Virus

Bovine Herpes Virus Type 1 (BHV-1) is the cause of infectious bovine rhinotracheitis (IBR) in cattle, a severe respiratory tract infection that can lead to complications such as abortion in pregnant cows and a substantial reduction in milk and meat production. BHV-1 is also a contributing factor in Bovine Respiratory Disease Complex (BRDC), otherwise known as shipping fever.

BHV-1, as well as most modified live BHV-1 vaccine strains, establishes a lifelong latent infection in cattle. Periodically throughout the life of the animal, a latent virus can reactivate due to stress, which may result in nasal viral shedding, providing a constant source for new infections and maintaining the virus in cattle populations. IBR causes considerable losses for the cattle industry worldwide, and BRDC is estimated to cost the U.S. cattle industry at least $1 billion annually.

Dr. Shafiqul Chowdhury’s laboratory has developed a genetically engineered vaccine for immunization of cattle against BHV-1. The genetically engineered virus lacks the critical amino acid residues of a viral envelope protein important for suppressing the initial immune response following virus infection. In addition, this virus lacks the ability to reactivate from latency. Based on a vaccine efficacy study, this virus induces a significantly better protective immune response in calves against BHV-1 compared with vaccines for the wild type virus in the field and the BHV-1 marker vaccine. Therefore, compared to the currently available vaccines, cattle vaccinated with the engineered vaccine virus will be better protected against the BHV-1 infection. A patent for this new vaccine has been filed by LSU.

Swine Fever and Porcine Circo Virus

While not currently found in the U.S., classical swine fever (hog cholera) exists in Europe and other countries and has a 100 percent mortality rate. Porcine circo virus-2 (PCV2) is strongly associated with the occurrence of postweaning multisystemic wasting syndrome (PMWS) and usually occurs in nursing or young pigs (from 6 weeks of age onward); it also appears to have an association with porcine respiratory disease complex (PRDC) and occasionally with reproductive failure. PCV2-associated diseases have 70 to 80 percent mortality rates in piglets. With funding from Ceva Santé Animale, Dr. Chowdhury’s laboratory is working to develop vaccines using a pseudorabies virus of swine (a herpes virus of swine associated with respiratory infections) as a vector to express classical swine fever and PCV2 protective antigens. The pseudorabies virus vector being used is a double-gene-deleted virus, so the vaccine virus is attenuated, does not reactivate or recur in the animal, and acts as a marker so veterinarians can distinguish vaccinated animals from infected animals.

Francisella sp.

Dr. John Hawke has developed a vaccine that protects fish against Francisella sp., an emergent bacterial pathogen that causes acute to chronic disease in warm-water-cultured and wild fish species, such as tilapia. Francisella has been implicated as the cause of mortality in warm and cold water species of fish in the U.S. (including Hawaii), Taiwan, Costa Rica, Latin America, Norway, Chile and Japan. Fish raised in high-density environments, such as tilapia farms, are more susceptible to outbreaks of the disease. Francisellosis causes high mortality in warm water fish farms. The
emerging disease is characterized by granulomas in the liver, spleen and kidney of fish maintained in 22-28° C water.

The vaccine is to be applied by immersion to 1-month-old tilapia fingerlings and should afford protection for at least one year. For fish vaccines to be economical, they need to be administered directly into the water rather than injected directly into each fish; the fish take in the vaccine bacteria through the gills and skin, from which they enter the bloodstream.

Dr. Hawke is seeking to partner with a commercial vaccine company to produce and market the vaccine. The vaccine is a live-attenuated mutant form of the parent strain that has a site-directed mutation in the iglC gene located in the Francisella pathogenicity island of the Francisella chromosome. The live-attenuated mutant that comprises the vaccine strain is capable of infecting and causing a mild form of the disease in young fish but is cleared in a short period of time. The induced immunity is characterized by both a heightened cellular and humoral response. Some of the research to develop this vaccine was conducted as part of the dissertation of Esteban Soto, PhD (LSU SVM 2010), who is now on faculty at Ross University in St. Kitts.

In 2010, global production of tilapia was estimated to be 3.7 million tons, according to the Food and Agriculture Organization of the United Nations. Tilapia can be produced in versatile locations, water systems, temperatures and salinities. They grow fast, have a high fillet yield and low feed-conversion ratio, as well as firm, white fillets that make tilapia easy to market.

**Herpes Simplex**

Dr. Konstantin “Gus” Kousoulas has developed a live-attenuated vaccine that can protect against herpes simplex infections, without the risk of producing more virulent viruses. The vaccine generates protective immunity against herpes simplex infections but cannot enter into neurons and establish latency. Unlike other herpes vaccines, it is anticipated that this vaccine could also be used for therapeutic treatment of recurrent herpes infections in infected humans.

The vaccine is based on research focused on how the virus enters cells and spreads from one cell to another. Following herpes simplex virus exposure, the virus enters neurons and becomes latent; the virus reactivates upon exposure to an external stimulus such as stress, heat and the general status of the immune system. In the vaccine virus, modifications in viral glycoprotein prevent the virus from entering into neurons; however, vaccinated animals become protected against further herpes simplex virus infection.
SU SVM aquatic pathobiology researchers work with both fresh water and marine fish populations. Areas being studied include *Edwardsiella ictaluri*, *Photobacterium damselae* subsp. *piscicida*, environmental contaminants, White Spot Syndrome Virus in crawfish and *Francisella noatunensis*.

**Disease Prevention**

Dr. Ronald Thune’s research covers economically important species (specifically, farmed channel catfish and marine fish species such as hybrid striped bass) and focuses on disease prevention in commercial aquaculture; he has already patented two vaccines. However, he is trying to build better vaccines by improving the delivery system. Currently, the vaccines are delivered to fish via the water tanks in the hatchery. The hope is to find a way to deliver a vaccine orally when the fish are in larger bodies of water like ponds.

Dr. Thune is primarily studying two bacteria: *Edwardsiella ictaluri*, which causes enteric septicemia (ESC) in catfish, and *Photobacterium damselae* subsp. *piscicida*, which affects marine fish species in the Mediterranean, Japan and the U.S. Gulf Coast. ESC is spread by infected fish via water contamination or by cannibalism of dead or infected fish. Birds can also pick up infected fish from one pond and drop them into another. These bacteria are virulent and spread quickly. Dr. Thune is trying to create better vaccines for these bacteria by studying their pathogenesis and how they cause disease.

**Toxicology**

Dr. Kevin Kleinow specializes in environmental health issues, especially those related to fish. He studies how contaminants in the environment affect fish and how those interactions may affect other organisms, including humans. Much of Dr. Kleinow’s work with fish has centered on how fish deal with environmental contaminants or drugs. Biotransformation of chemicals to more excretable forms and transport within and out of the fish are major components of these studies. The outcome of these processing events is influential in the food chain transfer of chemicals through the aquatic and marine food chains and to humans. During studies examining the bioavailability and fate of chemicals known to be endocrine-disrupting chemicals, Dr. Kleinow noted increased bioavailability and retention of co-exposed dietary chemicals. He noted that the chemicals that elicited this behavior were also surfactants. He correlated that surfactants, when added in significant amounts, increased intestinal bioavailability of oral medicines and inhibited transporters involved in drug excretion. From these observations and uses, Dr. Kleinow postulated that surfactants discharged in the environment—even at low concentrations—would alter the uptake, excretion, retention and potential toxicity of other chemicals in the environmental food chain. Subsequent work in his
The laboratory showed that surfactants change the permeability of membranes in the intestinal wall and places of excretion, such as the biliary tract.

Dr. Kleinow said, “It’s sort of like a levee along the river. If the levee is leaking and our pump is big enough, we pump the water back over the other side and there’s no problem. But if the leak becomes too big, the pumps won’t be able to keep up, and we get water over here. And that’s what happens with the surfactant; it progressively increases the permeability so more and more compound gets into the animal from the higher contaminant concentration in the diet in the intestine, increasing bioavailability.

“In a similar fashion, but with opposite results, surfactants prevent the transporter-mediated concentration of contaminants into the bile necessary for excretion. Leakage back from the bile lowers the amount of contaminant available for excretion. For both venues the net result is increased compound equivalents in the fish. Surfactants themselves have low relative toxicity as a group and hence widespread use in shampoos, detergents and the like, could facilitate the toxicity of other chemicals potentially much more hazardous to the fish.”

Diagnostics

Dr. John Hawke is perhaps best known as the discoverer of enteric septicemia of catfish and for describing the causative bacterium, Edwardsiella ictaluri, while working at Auburn University, Department of Fisheries and Allied Aquacultures, in the late 1970s. He joined the SVM as a research associate in 1985. In September 2010, he received the S.F. Snieszko Award from the American Fisheries Society, the highest award in the Fish Health Section presented for the purpose of honoring individuals for outstanding accomplishments in the field of aquatic animal health.

Dr. Hawke is studying two pathogens new to the aquaculture industry in Louisiana: White Spot Syndrome Virus (WSSV) in crawfish, and a newly recognized subspecies of the bacterium Francisella noatunensis, which can cause high mortality in farmed tilapia.

WSSV, so named because of the abnormal calcium deposits it causes on the shells of some species of infected crustaceans, is an important viral pathogen of cultured shrimp worldwide. Prior to 2007, however, no viral disease had ever been reported from crawfish in Louisiana or anywhere else in the U.S.

“In the spring of 2007,” said Dr. Hawke, “we started receiving reports of several crawfish farms that were experiencing heavy mortality among their red swamp crawfish and white river crawfish. After we performed postmortem exams on the dead crawfish, we found microscopic evidence of a severe viral infection.”

WSSV in crawfish does not actually produce white spots on the shells, so it is difficult to recognize without laboratory testing. Affected crawfish appear weak and lethargic and cannot walk without losing their balance; as the virus invades multiple organ systems, they eventually die. After a survey revealed that crawfish from over 60 percent of the sites were infected with the virus, WSSV was declared endemic in Louisiana. Fortunately, the economic losses to the state’s $96 million crawfish industry from WSSV have not, to date, been too severe, but Dr. Hawke and the Louisiana Animal Disease Diagnostic Laboratory continue their research to learn more about this new pathogen and to work on developing a rapid test to detect the presence of the virus in crawfish.

Dr. Hawke also studies a bacterial disease of tilapia caused by Francisella noatunensis. This microorganism causes granulomatous inflammation of the internal organs and skin and is very closely related to the organism that causes tularemia in humans. It is very possible that these studies in fish will lead to a better understanding of a disease in humans.
Translational research takes molecular research and “translates” it to practical applications, and in essence is a large part of the common phrase used by research institutions across the country: “from bench to bedside.” At the LSU SVM, Dr. Margaret A. McNulty is conducting research that could eventually have great impact on human health. Her research focuses on bone and joint pathology and methods of improving diseases affecting both organs.

Dr. McNulty says about translational research: “Molecular research shows us that a particular drug can grow bone by stimulating the osteoblasts, the cells that make bone, in culture. The next step is to give the drug to rats that have bone implants to see if bone will grow better around the implant when they’re administered the drug. If successful, the data accumulated will then hopefully lead to clinical human trials as part of the Food & Drug Administration approval process for a drug to improve implant fixation following total hip or knee replacements.”

In addition to evaluating the effectiveness of a drug, translational research also provides an opportunity to evaluate potential negative side effects prior to being administered to humans in Phase 1 clinical trials. This research, both to evaluate the effectiveness and identify potential negative side effects, also benefits animals, as these same drugs are often utilized as off-label treatments in veterinary medicine to aid in animal health. This gives translational research an even broader scope when evaluating the effect of a particular compound on a disease.

Dr. McNulty uses micro-computed tomography (micro-CT), which allows her to evaluate structures that attenuate x-rays (e.g., bone) to determine morphologic changes in these tissues. “It’s like an x-ray in 3-D or CT in humans but on a micro-scale. We can look at smaller animals at a higher resolution,” said Dr. McNulty. Generally, micro-CT is utilized to evaluate bone, as it naturally attenuates x-rays. However, other tissues that do not attenuate x-rays, such as vessels or cartilage, can be imaged by utilizing contrast agents. These are the same contrast agents used in human medicine, such as iodine or barium compounds, which will show up on radiographs, and therefore micro-CT. In addition, the micro scale that can be achieved by the scanner allows small samples, such as the bones of mice, to be imaged, whereas traditional medical CTs could not. For example, average hospital CTs have a resolution of about 1-2mm, which is even larger than an entire mouse bone, let alone the components that make up the bone. Micro-CT operates on a micrometer scale, with resolutions on the LSU SVM’s machine reaching as low as 6µm, which allows researchers to easily visualize the smaller structures associated with tissues in small animals.

In collaboration with researchers at Auburn University, Dr. McNulty is evaluating a developmental skeletal defect in cats. “We’re looking at musculoskeletal deformities in cats, where the cats have abnormal gaits that progress to the point that the cats need to be euthanized,” said...
Dr. McNulty. “We’re seeing unusual bone lesions in these cats, and we’re analyzing the morphology of the bone to determine the cause.”

Another collaborative study with researchers at Johns Hopkins University is evaluating the pathogenesis of a rat model of Crouzon’s disease, which is a developmental disorder in humans where the seams between the bones of the skull fuse prematurely, which subsequently leads to craniofacial defects. By evaluating the disease progression in an animal model, this information can then be applied to humans to further research focused on finding a treatment or cure, or better yet, to prevent the disease in the first place.

As noted above, micro-CT has applications that go beyond bone. Dr. McNulty is also working with researchers at the LSU Health Sciences Center to utilize contrast agents to visualize structures in alligator embryos, specifically the brain. After the embryos are soaked, different tissues (e.g., brain, cartilage, fibrous structures) take up the iodine to various degrees, which then appear on the CT scans as multiple shades of grey so they are distinguishable. This project will allow researchers to further understand the neuronal development of the alligator and subsequently other species.

Dr. McNulty is also working on a project with Dr. Colin Mitchell to look at the effect of bisphosphonates on bone remodeling in the horse. The project is in the early stages (preparing grant applications), so collection of preliminary data has yet to begin; however, Dr. Mitchell will obtain the bone samples from live horses via standing biopsies. Dr. Mitchell has taken a test scan of one of the biopsies to test the technique.

In addition, as an avid anatomist and a professor in the professional veterinary anatomy courses within the SVM, Dr. McNulty plans to utilize the scans from the above studies, especially the images from embryos, to create 3D reconstructions for veterinary student learning. Embryology, or the study of the development of the embryo, is often a difficult subject for students. Prior educational research in medical schools has shown that 3D imaging enhances student learning in the anatomical sciences. Therefore, providing LSU veterinary students with 3D images of embryos at the different stages will advance their understanding of the material being taught in the professional curriculum. The images created of bones and other structures from various other species, in both normal and pathologic states, will also be helpful in teaching students the fundamental anatomical components of bone and how the tissue changes based on abnormalities associated with various diseases.
Facilities and Equipment

Core facilities in the LSU School of Veterinary Medicine (SVM), including the Microscopy Center, the Flow Cytometry laboratory, the Cell and Organ Culture laboratory, the BSL-3 laboratory for select agents, the Division of Laboratory Animal Medicine, and the Division of Biotechnology and Molecular Medicine, provide unique services and equipment for faculty.

Microscopy Center
Within the Department of Comparative Biomedical Sciences (CBS), under the direction of Dr. Xiaochu Wu, the Microscopy Center houses a superb array of equipment that includes a laser capture microdissection microscope, a confocal microscope that allows users to perform three-dimensional microscopy of fluorescently labeled specimens, a transmission electron microscope (TEM is an imaging technique where a beam of electrons is focused onto a specimen causing a magnified image to appear on a phosphorescent screen or on photographic film), a scanning electron microscope with EDS (a high resolution environmental microscope with improved image resolution and contrast), a fluorescent microscope, a cryo-microtome, an image process workstation, and a wide array of other imaging instrumentation.

Analytical Systems Laboratories
The Analytical Systems Laboratories (ASL) are central service, comprehensive analytical laboratories operated under the direction of Dr. Steven Barker. ASL consists of the Laboratory for Drug Residue Studies, the Equine Medication Surveillance Laboratory and the Analytical Systems Laboratory. The Laboratory for Drug Residue Studies, established in 1991, provides instrumentation and expertise for the performance of drug and biological molecule pharmacokinetics, metabolism, tissue distribution and analytical method development. These laboratories have operated under Federal Good Laboratory Practices regulations and have generated data for the U.S. Food and Drug Administration (FDA) and private industry for submission for veterinary drug approvals in the U.S. and member states of the European Union. The Equine Medication Surveillance Laboratory, established in 1987, serves as the official drug testing laboratory for the Louisiana State Racing Commission. The laboratory screens more than 8,000 urine and 8,000 blood samples per year and has developed sophisticated methodology for detection and confirmation of a wide range of drugs and their metabolites. The laboratory also serves as a source of information to the racing industry and the citizens of Louisiana regarding both animal and human drug pharmacology, metabolism and clearance.

The ASL houses advanced chromatography and mass spectrometry equipment that is used to support the research of the SVM and other LSU faculty and graduate students. Equipment in these laboratories includes a Micromass 2D-Capillary Liquid Chromatography-Quadrupole-Time-of-Flight mass spectrometer (2D-CLC-QToF), a Thermo LTQ-XL linear ion-trap LC-MS system, a Thermo LTQ-Velos linear ion-trap-ion-trap LC-MS system, a Thermo Quantum Access triple-stage-quadrupole (TSQ) LC-MS system, a Thermo Quantum Advantage triple-stage-quadrupole (TSQ) mass spectrometer equipped with an Aria Turboflow sample preparation and introduction system, a Thermo Exactive high-resolution LC/Orbitrap MS, a HP 1090 II, low-flow HPLC (1 ul/min), six Agilent 1100 and 1200 series HPLCs, an HP 5973 and a 5975 GC/MS system, as well as other equipment.

Inhalation Research Facility
The Inhalation Research Facility, directed by Dr. Arthur Penn, enables studies to be conducted on the effect of various pollutants and other substances on a variety of diseases, including asthma and cardiovascular diseases.

Aquatic Toxicology Laboratories
The Aquatic Toxicology Laboratories are housed in the main SVM building, as well as in a free-standing Aquatic Building (part of the Cooperative Aquatic Animal Health Research Program). Facilities include state-of-the-art aquatic animal holding, rearing, exposure, surgical and preparative areas. Wet laboratory space dedicated to toxicology encompasses five laboratories with approximately 1,500 square feet of space. Laboratories within the unit are flow-through equipped with complete room and water temperature control (5 to 40°C), redundant air delivery, dechlorinated and purified water supply, in-line pH and hardness adjustment, toxicant recovery system, photoperiod control and emergency power backup. Water flows in individual rooms from 10 to 30 gallons per minute. Facilities are equipped with tanks ranging in size from 5-gallon glass to 500-gallon fiberglass tanks. Two specialized hooded HEPA-filtered exposure rooms with associated preparative areas (salt and freshwater capable) are designed for high hazard exposures. Facilities contain a proportional dilutor, Lazy Susan treatment suites, cannula, catheter and gavage tending systems, a radiolabel exposure unit, and traditional rack- and bath-based systems. Support preparative rooms (300 square feet) are equipped with an aquatic surgical table, balances, water quality monitoring equipment, food mill, freezers, and supportive exposure and preparative equipment. Analysis capabilities are associated with individual investigator laboratories and centralized facilities within the LSU SVM.
Division of Biotechnology and Molecular Medicine

BioMMED conducts innovative research to determine the molecular basis of various diseases, as well as to develop novel therapeutics for the treatment of cancer and infectious diseases. It provides centralized access to state-of-the-art equipment and advanced training in molecular and cell biology and also oversees three National Institutes of Health, National Center for Research Resources-funded research cores: The Non-Human Primate Laboratory Core, the Molecular Biology and Immunology Core Laboratories, and a Louisiana undergraduate institution molecular and cell biology training core. BioMMED is comprised of five service-oriented centralized core laboratories: 1) GeneLab; 2) Cellular and Non-Invasive Whole Animal In Vivo Imaging Laboratory; 3) Bioinformatics, Computational and Visualization Laboratory; 4) Viral Vector Laboratories; and 5) Protein and Antibody Production and Purification Laboratory.

Flow Cytometry Facility

The Flow Cytometry Facility is a core laboratory in the Department of Pathobiological Sciences. The appointment of Marilyn Dietrich as core manager provides the assignment of a full-time instructor-level position to the facility. She affords technical assistance to flow cytometric techniques, participation in the development of applications, and the performance of daily responsibilities such as operation, scheduling, data management and routine maintenance of the facility's instruments. The facility features a BD Biosciences FACSAria triple laser flow cytometer/sorter capable of measuring two light scatter parameters and nine fluorescence emissions, as well as four-way cell sorting capacity. In addition, the facility has a BD Biosciences Calibur dual laser benchtop flow cytometer capable of measuring two light scatter parameters and four fluorescence emissions, as well as a sorting option capable of performing single population sorts. The laboratory also features a BD Biosciences FACScan benchtop flow cytometer with a single laser capability and three color emissions. Additional support entails the annual purchase of service contracts for the instruments and periodic acquisitions of enhancement and replacement equipment. The most recent upgrade of the FACSAria flow cytometer to a three laser system offers the selection of a wide variety of fluorochromes for subsequent detection of cancer cells for an upcoming research project. Multicolor immunophenotyping, cell cycle analysis, apoptosis studies, cell sorting and cell proliferation assays are examples of research applications performed routinely in this laboratory. Clinical and diagnostic applications routinely conducted in the facility in conjunction with the SVM Cancer Treatment Unit include canine leukemia and lymphoma determination. This unique centralized facility provides analytical capabilities for investigators throughout the LSU System, including the LSU Agricultural Center and the LSU Pennington Biomedical Research Center. Other institutions that heavily use the facility include the National Hansen's Disease Research Program and the Louisiana Emerging Technology Center. The LSU SVM has operated the Flow Cytometry Facility since 1986 and was the first institution in the state to purchase a flow cytometer. The facility also provides an exceptional opportunity for veterinary and graduate students and post-doctoral fellows to become knowledgeable about the operation and applications of flow cytometric technology. These learning experiences can occur formally through a hands-on laboratory course on flow cytometry (PBS 7413 or VMED 5010) or informally through graduate and post-graduate research projects.

Gene Probes and Expression Systems Laboratory

Since its inception in 1990, the GeneLab has assisted more than 300 biomedical, biological and agricultural researchers in Louisiana with molecular biological experiments. The GeneLab currently provides conventional and NGS nucleic acid sequencing, recombinant DNA services (gene cloning, mutagenesis, library construction), viral vector construction, quantitative PCR (qPCR) analysis, and reagents and supplies needed for biotechnology experiments. It also provides software and bioinformatics support for analysis of data. The GeneLab also administers two freezer programs for Life technologies, providing reduced cost (20 percent-30 percent less than list price) and almost instantly available reagents from Invitrogen and applied biosystems. GeneLab equipment is available to LSU researchers practically 24 hours a day, 7 days a week. Scheduling and reservation of GeneLab equipment can be made using the internet-based iLAB organizer. The GeneLab provides assistance with recombinant DNA tasks and has successfully trained a number of LSU researchers in the effective use of advanced molecular biological equipment.

Division of Laboratory Animal Medicine

DLAM serves as a central administrative division for the operation of two research animal holding facilities: the LSU SVM Laboratory Animal Medicine Facility and the Life Sciences Animal Care Facility. DLAM purchases, maintains and cares for all teaching and research animals housed within these facilities. The animal care facilities, equipment and program are accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International. DLAM’s objective is to maintain a fully accredited animal care program supporting teaching, research and service.
The research interest of faculty with active laboratories is listed by department with the major research cluster also identified. Research clusters include infectious disease (ID), cancer biology and therapy (CB), molecular medicine (MM), vector biology (VB), respiratory pathobiology (RP), the Equine Health Studies Program (EHSP) and clinical studies (CS).

COMPARATIVE BIOMEDICAL SCIENCES

F. Kareem Al-Bagdadi, BVMS, MS, MS, PhD, Associate Professor of Veterinary Anatomy and Cell Biology: Skin, axon wallerian degeneration, lymphocytic leukemia transferred from bovine to other species, influence of body temperature on cryptorchid testes, and the influence of alcohol addiction on the liver and kidney HeLa cell. MM

Steven A. Barker, MS, PhD, Professor of Veterinary Physiology, Pharmacology and Toxicology; Director, Equine Medication Surveillance Laboratory; Director, Analytical Systems Laboratory: Analytical toxicology and the neurochemistry of hallucinogens. MM

Hermann H. Bragulla, DVM, PhD, Associate Professor: Morphology and development of skin and cornified structures (e.g., claws), baleen in whales and whale ears.

Henrique Cheng, DVM, MS, PhD, Associate Professor: Cellular and molecular signals controlling stem cell differentiation. MM

Ji-Ming Feng, MS, PhD, Associate Professor: Molecular regulations of calcium signaling in T-cells and their roles in autoimmune diseases. MM

Joseph Francis, BVSc, MVSc, PhD, Professor: Brain mechanisms regulating cardiovascular function. MM

Kazuo Imaizumi, DVM, MS, PhD, Research Assistant Professor: Developmental plasticity of inhibitory neurons in the central auditory system.

Kevin M. Kleinow, DVM, PhD, Professor of Veterinary Physiology, Pharmacology and Toxicology: Mechanistic and applied aspects of aquatic animal toxicology, physiology and pharmacology. MM

Charles Lee, PhD, Assistant Professor (Comparative Biomedical Sciences): Neurobiology, focusing on sensory systems, e.g., auditory, somatosensory and visual systems. MM

Shisheng Li, PhD, Associate Professor: DNA damage and repair mechanisms. MM

J. Michael Mathis, PhD, MHA (LSU 2011), Professor and Head: Signaling pathways in cancer; molecular imaging agents for cancer detection; targeted cancer treatments using adenovirus-based gene therapy, immunotherapy, and virotherapy vectors. CB

Margaret McNulty, PhD, Assistant Professor: Orthopedics, educational research and advanced imaging. MM

Arthur L. Penn, PhD, Professor of Toxicology; Director, Inhalation Research Facility: Role of inhaled air pollutants in cardiovascular and respiratory diseases. RP, MM

Inder Sehgal, DVM, PhD, Associate Professor: Mechanisms for prostate cancer metastasis. MM, CB

George M. Strain, PhD, FAVAP, Professor of Veterinary Physiology, Pharmacology and Toxicology: Deafness, epilepsy, experimental neurology and autonomic nervous system. MM, CS

Gary E. Wise, PhD, Professor Emeritus, Head Emeritus: Molecular basis of tooth eruption. MM

Xiaochu Wu, MS, MS, PhD, Instructor; Director, Microscopy Center: Endogenously generated H_2 S and precise measurement of the nano quantity and low concentration H_2 S in a mammalian body.

Shaomian Yao, MS (LSU 1997), PhD (LSU 2001), Assistant Professor: Molecular regulation of bone resorption and formation, and purification and differentiation of stem cells. MM

Masami Yoshimura, MSSc, DSc, Associate Professor: Molecular and cellular biological aspects of the regulation of cyclic AMP signal transduction. MM

PATHOBIOLOGICAL SCIENCES

David G. Baker, DVM, PhD, MPA (LSU 2009), DACLAM, Professor of Laboratory Animal Medicine; Director, Division of Laboratory Animal Medicine: Parasitic and infectious diseases of laboratory animals. ID

Sanjay Batra, MS, PhD, Research Assistant Professor: Role of hematopoietic and/or resident cell-driven RIP2/NLR-mediated immune responses during bacterial pneumonia and in COPD/emphysema. RP

Shanshan Cai, MS, PhD, Research Assistant Professor-Research: Innate immune mechanisms in respiratory diseases. RP

Vladimir Chouljenko, PhD, Research Assistant Professor; Assistant Director, Division of Biotechnology and Molecular Medicine: Virus vectors construction and next generation sequencing using ion PGM and ion proton. ID
Shafiqul Chowdhury, DVM, MS, PhD, Professor: Molecular virology and recombinant vaccine technology of bovine herpesviruses. ID, RP

Fabio Del Piero, DVM, PhD, DACVP, Professor: Pathogenesis of infectious diseases and comparative pathology. ID

Stephen Gaunt, DVM (LSU SVM 1977), MS (LSU SVM 1979), PhD, DACVP, Professor of Veterinary Clinical Pathology; Section Chief and Applied Diagnostics, Veterinary Teaching Hospital: Ehrlichial and anaplasmal infections of dogs. CS

Britton Grasperge, DVM (LSU SVM 2006), PhD (LSU SVM 2012), DACVP, Assistant Professor: Influence of tick saliva on transmission of tick-borne diseases. VB

Antonieta Guerrero-Plata, BSc, MSc, PhD, Assistant Professor: Immune mechanisms to respiratory syncytial virus and human metapneumovirus. RP

Muzammel Haque, PhD, Research Assistant Professor: Pathogenesis of Kaposi’s Sarcoma-associated herpesvirus, focusing on regulatory protein-protein interactions that determine viral latency and reactivation. ID

John P. Hawke, MS, PhD (LSU SVM 1996), Professor of Veterinary Microbiology and Parasitology: Emerging infectious diseases of cultured marine and freshwater fish. ID

Samithamby Jeyaseelan, DVM, PhD, Professor: Pulmonary inflammation; antibacterial host defense. ID, RP

Thomas R. Klei, PhD, Boyd Professor; Professor of Veterinary Microbiology and Parasitology: Immunopathogenic and regulatory mechanisms involved in human filariasis. ID, VB

Konstantin “Gus” Kousoulas, MS, PhD, Professor of Veterinary Virology; Director, Division of Biotechnology and Molecular Medicine: Molecular biology and pathogenesis of herpesviruses and coronaviruses. ID, CB, MM

Ritwick Kulkarni, BSc, MSc, PhD, Research Assistant Professor: Effects of cigarette smoke exposure on the virulence of bacterial pathogens that cause respiratory tract infections. ID, RP

Ingeborg Langohr, MS, PhD, DACVP, Associate Professor: Dietary lipids and silica-accelerated autoimmunity. CS

Fang-Ting Liang, MS, PhD, Associate Professor: Pathogenesis of *Borrelia burgdorferi*. ID, VB

Kevin R. Macaluso, MS, PhD, Professor: Tick-borne rickettsial diseases and interactions between arthropods and rickettsiae facilitating pathogen transmission. ID, VB

John B. Malone, Jr., DVM, PhD, Professor of Veterinary Parasitology: Use of earth-observing satellite imagery and

Geographic Information Systems to evaluate the suitability of environment for disease agents. ID

Juan J. Martinez, PhD, Associate Professor: Roles of conserved outer-membrane proteins in the pathogenesis of Spotted Fever Group (SFG) rickettsial infections. VB

Leslie McLaughlin, DVM (LSU SVM 1998), PhD (LSU SVM 2005), Assistant Professor: Inflammation, oxidative and endoplasmic reticulum stress, and neuroprotective mechanisms in the pathophysiology of PTSD in animal models. CS

Smriti Mehra, PhD, Assistant Professor: Host-pathogen in the respiratory tract using nonhuman primate models. ID, RP

James E. Miller, DVM, MPVM, PhD, Professor of Epidemiology and Community Health; Interim Associate Dean for Research and Advanced Studies: Epidemiology, control and genetics of ruminant nematode parasitism. ID

Christopher Mores, SM, ScD, Associate Professor: Mechanisms by which arthropod-borne viruses persist in, emerge from, and expand to particular ecologies, transmission cycles and regions. ID, VB

Daniel B. Paulsen, DVM, MS, PhD, DACVP, Professor of Veterinary Pathology; Director, Louisiana Animal Disease Diagnostic Laboratory: Bovine respiratory disease. ID, RP

Alma Roy, MS, PhD (LSU SVM 2000), Assistant Professor of Veterinary Microbiology and Parasitology; Associate Director, Louisiana Animal Disease Diagnostic Laboratory: West Nile Virus. VB

Yanlin Shi, MS, PhD (LSU 2005), Research Assistant Professor: Using molecular methods to study the spirochete *Borrelia burgdorferi*. RP

Rhett W. Stout, DVM (LSU SVM 1994), PhD (LSU SVM 2003), DACLAM, Assistant Professor of Laboratory Animal Medicine; Associate Director, Division of Laboratory Medicine: Pharmacology and toxicology of investigational new drugs; laboratory animal medicine. CS, ID

Ronald L. Thune, MS, PhD, Professor of Aquatic Animal Health and Head: Pathogenesis of infectious diseases of aquatic animals. ID

Noboku Wakamatsu Utsuki, DVM, PhD, DACVP, DACPV, Associate Professor: Necropsy service, biopsy service, instruction and research. CS
VETERINARY CLINICAL SCIENCES

Mark Acierno, DVM, MBA, DACVIM, Associate Professor of Companion Animal Medicine: Renal diseases, hypertension and renal replacement technologies. CS

Frank M. Andrews, DVM, DACVIM, Professor of Veterinary Medicine; Director, Equine Health Studies Program: Gastric ulcer disease, neurological diseases and Cushing’s disease in horses. EHSP

David Beehan, DVM, MS (LSU SVM 2012), DACT, Instructor of Theriogenology: Effects of iodixanol present during equine semen cryopreservation. CS

Bonnie Brugmann Boudreaux, DVM, MS, DACVIM, Clinical Assistant Professor of Veterinary Oncology: Clinical oncology. CB, CS

Daniel J. Burba, DVM, DACVS, Professor of Veterinary Surgery: Equine arthritis, cartilage healing and laser surgery. EHSP

Ann M. Chapman, DVM (LSU SVM 2001), MS (LSU SVM 2006), DACVIM, Assistant Professor of Equine Medicine: Salmonellosis and Lawsonia intracellularis. ID

Anderson F. da Cunha, DVM, MS, DACVA, Assistant Professor of Veterinary Anesthesiology: Interaction of the vanilloid receptor with the pain pathway. CS

Susan C. Eades, DVM (LSU SVM 1982), PhD, DACVIM, Professor of Veterinary Medicine: Equine laminitis, equine colic and foal diseases. EHSP

Michelle Ellison, VMD, DACVR, Assistant Professor, Diagnostic Imaging: Functional tendon ultrasound and thyroid scintigraphy in rabbits. CS

Jon Fletcher, DVM (LSU SVM 2005), DACVIM, Assistant Professor of Companion Animal Medicine: Endocrinology, feline hyperthyroidism and diabetes mellitus. CS

Frederic P. Gaschen, Dr.med.vet., Dr.habil., DACVIM, DECVM, Professor of Companion Animal Medicine: Chronic intestinal diseases, food intolerance and food allergy, gastrointestinal motility and nosocomial (or hospital) infections. CS

Lorrie E. Gaschen, DVM, PhD, DECVDI, Professor of Diagnostic Imaging: Vascular imaging and ultrasound of the gastrointestinal tract and pancreas, and MRI studies in structure and function in small and large animals. CS

L. Abbigail Granger, DVM, DACVR, Assistant Professor of Diagnostic Imaging: GFR analysis using functional computed tomography, high resolution thoracic computed tomography and pancreatic ultrasonography. CS

Amy M. Grooters, DVM, DACVIM, Professor of Companion Animal Medicine: Pythiosis, lagenidiosis, zygomycosis and molecular mycology. CS

Stephanie W. Johnson, MSW (LSU 1992), LCSW, Assistant Professor; Counselor (Office of Student and Academic Affairs): Student personality types, learning styles, and the effects on teaching and learning.

Mandi J. Lopez, DVM, MS, PhD, DACVS, Associate Professor; Director, Laboratory for Equine and Comparative Orthopedic Research: Biomechanics, medical device design, canine cranial cruciate disease, canine hip dysplasia, motion analysis and equine orthopedics. EHSP

Sara K. Lyle, DVM, MS, PhD (LSU SVM 2008), DACT, Assistant Professor of Theriogenology: Placentitis, infertility and assisted reproductive technologies in the mare. EHSP

Rebecca S. McConnico, DVM (LSU SVM 1987), PhD, DACVIM, Professor of Veterinary Medicine: Equine and comparative gastrointestinal physiology, pharmacology and disaster medicine. EHSP

Mustajab H. Mirza, DVM, MS (LSU SVM 1998), Assistant Professor of Equine Surgery: Laminitis. EHSP

Colin Mitchell, BVMS, MS, DACVS, Associate Professor of Equine Surgery: Gastrointestinal motility and orthopedic disease. EHSP

Javier G. Nevarez, DVM (LSU SVM 2001), PhD (LSU SVM 2007), DACZM, DECZM, Associate Professor of Zoological Medicine: Crocodilian medicine and aquaculture. CS

Dale L. Paccamonti, DVM, MS, DACT, Professor of Theriogenology and Head: Mare infertility, equine pregnancy and parturition, and stallion semen preservation. EHSP

Romain Pariaut, DVM, DACVIM, DECVIM, Associate Professor of Veterinary Cardiology: Mechanisms, diagnosis and treatment of congestive heart failure and interventional cardiology. CS

Cherie Pucheu-Haston, DVM (LSU SVM 1992), PhD, DACVD, Assistant Professor of Dermatology: Cutaneous and respiratory hypersensitivity, food hypersensitivity, proteolytic allergens and the development of hypersensitivity, and development of improved diagnostic techniques for the identification of specific food and environmental allergens. CS

Patricia Queiroz-Williams, DVM, MS, Assistant Professor of Veterinary Anesthesiology: Cardiac output and pulse pressure variation in horses, minimal alveolar concentration of inhalants, and pain management (all species). CS

Nathalie Rademacher, DR, DACVR, DECVR, Assistant Professor of Diagnostic Imaging: Vascular imaging for pancreatic diseases, cardiogenic pulmonary edema diagnosis, and cross-sectional imaging. CS
Laura M. Riggs, DVM, PhD, DACVS, Assistant Professor of Equine Surgery: Laminitis and acute inflammation. EHSP

Duane Robinson, DVM, PhD, DACVS, Assistant Professor of Companion Animal Surgery: Implant associated infections, bacterial biofilms, biomaterial design to prevent infection, and surgical site infections. CS

Katrin Saile, DVM (LSU SVM 2006), MS, DACVS, Assistant Professor of Veterinary Surgery: Laryngeal surgery, tracheal collapse and stenting, and veterinary education. CS

Keiijo Shiomitsu, BVSc, DACVR, Assistant Professor of Veterinary Radiation Oncology: Angiogenesis, radiation sensitizer, and Intensity Modulated Radiation Therapy. CS, CB

Eric S. Storey, DVM, MVSc, DACVO, Associate Professor of Ophthalmology: Glaucoma, inherited retinal disease, and equine recurrent uveitis. CS

Julia Sumner, BVSc, DACVS, Assistant Professor of Companion Animal Surgery: Cranial and caudal cruciate ligament injury and repair. CS

Joseph Taboada, DVM, DACVIM, Professor of Veterinary Medicine; Associate Dean for Student and Academic Affairs: Student personality types, learning styles, and the effects on teaching and learning.

Thomas N. Tully, Jr., DVM (LSU SVM 1986), MS (LSU SVM 1991), DABVP, DECZM, Professor: Nutritional research (avian). CS

C.S. Venugopal, BVSc, MSc, MS, PhD, Professor of Veterinary Physiology, Pharmacology and Toxicology: Smooth muscle physiology. EHSP, RP

Andrew MacLean, PhD, Assistant Professor, Division of Comparative Pathology (TNPRC): Neuropathogenesis of AIDS using non-human primate models.

Nicholas J. Maness, PhD, Assistant Professor, Division of Microbiology (TNPRC): Pathogenesis of lyme diseases using non-human primate models.

Preston A. Marx, PhD, Professor of Tropical Medicine (Tulane School of Public Health and Tropical Medicine); Chair, Division of Microbiology (TNPRC): Pathogenesis of AIDS and vaccine development using non-human primate models.

Mahesh Mohan, DVM, MS, PhD, Assistant Professor, Division of Comparative Pathology (TNPRC): Pathogenesis of AIDS and enteropathy using non-human primate models.

Bapi Pahar, DVM, PhD, Assistant Professor, Division of Comparative Pathology (TNPRC): Immunology and pathogenesis of AIDS using non-human primate models.

Antonito Panganiban, PhD, Professor, Division of Microbiology (TNPRC): RNA virus replication and pathogenesis of emerging viruses using primate models.

Mario T. Philipp, PhD, Chair and Professor, Division of Bacteriology and Parasitology (TNPRC): Pathogenesis of Lyme disease using non-human primate models.

Vicki L. Traina-Dorge, PhD, Associate Professor, Division of Microbiology (TNPRC): Pathogenesis of human and simian T cell Leukemia Viruses, and Varicella Virus using non-human primate models.

Ronald S. Veazey, DVM, PhD, Chair and Professor of Pathology, Division of Comparative Pathology (TNPRC): AIDS pathogenesis and mucosal immunology using non-human primate models.

Andrew A. Lackner, DVM, PhD, DACVP, Professor and Director (TNPRC); Professor of Microbiology and Immunology and Pathology (Tulane University School of Medicine): Pathogenesis of AIDS non-human primate models.
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