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Perspectives



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Message from President Kirk Schulz and Vice President for Research Ron Trewyn



The Biosecurity Research Institute is already serving on the front line to protect the world's food supply.

Scientists from throughout the United States and around the world come to the institute to pursue research projects that require a high level of biocontainment and to collaborate with Kansas State University scientists, who are among the nation's best in their fields. Others come for training to permit them to work in biosafety level-3 and BSL-3 Ag facilities.

Here, scientists have the opportunity to conduct research on a myriad of plant and animal diseases and food safety pathogens. Researchers have a unique advantage for multidisciplinary research, training and educational activities, with capabilities unmatched anywhere else. There also are opportunities for selected Kansas State students to work on research projects in the facility.

The institute has the additional potential to help train personnel who will work at the National Bio and Agro-Defense Facility, which is currently being built on the Kansas State campus.

The Biosecurity Research Institute has been a magnet for research partners. The U.S. Department of Agriculture moved ABADRU, the Arthropod-Borne Animal Diseases Research Unit, from Laramie, Wyo., to Manhattan, Kan., in 2010 in part so government researchers could conduct studies at the Biosecurity Research Institute. Researchers at ABADRU study livestock diseases to ensure safe agriculture products and to help sustain the agricultural economy. The move confirmed Manhattan, Kan., as the international center for food safety and animal health research.

Also in 2010, the U.S. Department of Homeland Security established CEEZAD, the Center of Excellence for Emerging and Zoonotic Animal Diseases, at Kansas State University. CEEZAD works to develop and validate vaccines to create innovative devices to detect and diagnose threatening diseases and help implement systems to curtail human and animal disease threats.



Major breakthroughs in swine disease research conducted in the Biosecurity Research Institute have underscored the institute's relevance in infectious disease research both today and in the future. Researchers are developing the tools needed to detect high-consequence agents that would damage the agricultural economy.

Kansas State University is a national leader in emerging animal and zoonotic disease research, and the Biosecurity Research Institute is a vital part of this effort. It is a key component in reaching our goal to become a Top 50 Public Research University by 2025.

A handwritten signature in black ink, likely belonging to President Kirk Schulz.A handwritten signature in black ink, likely belonging to Vice President for Research Ron Trewyn.

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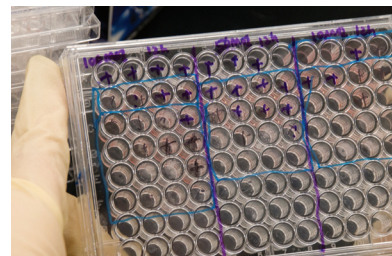
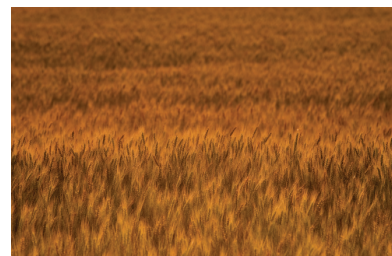
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PAT ROBERTS HALL

Infectious plant and animal diseases may be one of the biggest challenges for America. However, Kansas State University's Biosecurity Research Institute is a front-line offense in this microscopic battle.

"I believe the Biosecurity Research Institute is making America safer," said Stephen Higgs, the institute's research director, associate vice president for research and Peine biosecurity chair at Kansas State University. "We are conducting work critical to food safety and crop safety, and using education to develop the new generation of experts in these fields. We are preparing the United States to respond more effectively to these emerging diseases."

As well as its integral role in disease research, the facility is helping to kick-start the federal government's premier biosafety level-4 research facility, the National Bio and Agro-Defense Facility, or NBAF.

Changing of the guard

The U.S. Department of Homeland Security plans to phase out the aging Plum Island Animal Disease Center — a major animal disease research facility in New York — and replace it with NBAF in Manhattan, Kan. NBAF is under construction on the Kansas State University campus and adjacent to the Biosecurity Research Institute, creating a collaborative environment.

During the NBAF's construction, research on some of the diseases currently studied at Plum Island will transition to the institute. University and federal scientists will develop complementary projects and use them to launch research at NBAF once it opens.

"Essentially the institute is going to be a springboard to get NBAF research going as soon as possible," Higgs said. "As Plum Island ramps down, we are making sure that there is no drop-off in research and training on these pathogens."

Higgs said this is important because the nation cannot afford to have a period when work is not being done on these diseases.

Scientists at both institutions are working closely, and Biosecurity Research Institute scientists will begin projects related to pathogens studied at Plum Island, including classical swine fever and African swine fever. Scientists from the U.S. Department of Agriculture's Arthropod-Borne Animal Diseases Research Unit have begun collaborative research with the Center of Excellence for Emerging and Zoonotic Animal Diseases on a vaccine strain of Rift Valley fever at the institute — a disease that extends beyond Plum Island's capabilities.

Several Kansas State University scientists have also visited the Plum Island Center — including Higgs. At Plum Island, Higgs discussed the research transition and transboundary animal diseases, which occur in multiple countries and are capable of being carried to new countries.

"Starting these projects at the institute really opens up new possibilities for infectious disease research at the university that hasn't been possible in the past," Higgs said. "These are high-priority pathogens of major concern because they are a threat to our agricultural system and health. I really see this as being a whole new era at Kansas State University."

Continuing the critical work

The beginning of NBAF does not mean an end to research at the university's Biosecurity Research Institute. The scientists will still study crop- and food-based threats — fields NBAF will not study, and of course will continue with research on diseases of animals — advancing multidisciplinary research at the university, Higgs said.

Additionally, Higgs anticipates contractual research with corporations and industries, which will accelerate commercial breakthroughs in disease resistance and food safety.

"Right now we are continuing to increase our expertise and build upon our reputation so that when the doors open at NBAF and the requests come in asking if we can help with an important research project, we can say, 'Yes, we can do it,'" Higgs said.

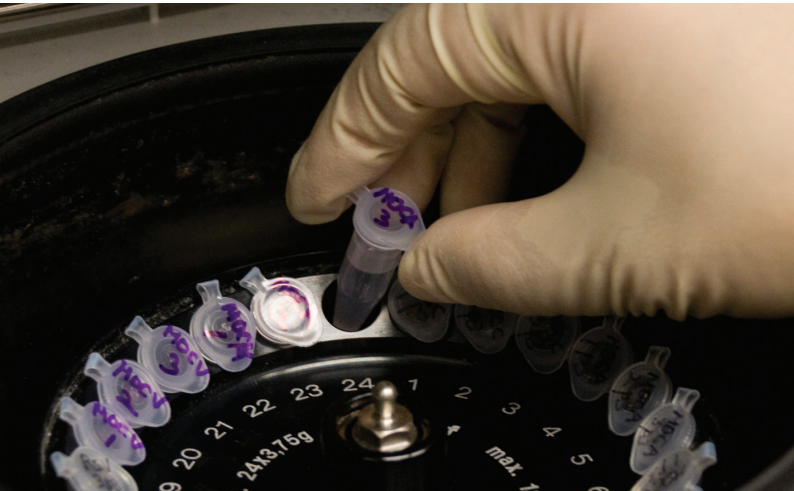


By Greg Tammen, Communications and Marketing

Securing the future

Zeroing in on zoonotic diseases

With CEEZAD and world-class researchers, Kansas State University is leading the battle against infectious diseases



“Zoonotic diseases do not only mean diseases that can spread from animals to humans,” Juergen Richt said. “They can also spread from humans to animals. These agents go both ways.”

Nearly 75 percent of recently emerging infectious diseases that affect humans come from animals, according to the Centers for Disease Control and Prevention.

Scientists like Juergen Richt, Regents distinguished professor and Kansas Bioscience Authority eminent scholar at Kansas State University, are fighting these emerging diseases through crucial research being performed at the university’s Biosecurity Research Institute.

Richt’s research focuses on zoonotic diseases, which are diseases that can spread between animal and human populations. Some zoonotic diseases, such as avian influenza and swine influenza, hold great risk to human and animal health as well as the agricultural economy. Richt wants to understand how these diseases adapt and change to develop vaccines and prevent future outbreaks.

Richt is the director of the U.S. Department of Homeland Security’s Center of Excellence for Emerging and Zoonotic Animal Diseases, or CEEZAD, which places Kansas State University as a leader in emerging animal and zoonotic disease research. Through CEEZAD, scientists conduct research, develop technology and train a specialized work force to defend the United States against agroterrorism, catastrophic events and emerging animal pathogens.

For his research at the Biosecurity Research Institute, Richt is collaborating with Wenjun Ma, assistant professor of diagnostic medicine and pathobiology, and several other researchers, including scientists with the U.S. Department of Agriculture’s Arthropod-Borne Animal Diseases Research Unit. Through the institute’s advanced research capabilities, the scientists are studying important zoonotic diseases, including avian influenza, pandemic H1N1, swine influenza and Rift Valley fever.

Avian influenza

By studying avian influenza, the researchers want to develop vaccines for poultry.

“Only a few studies have been performed with highly pathogenic avian influenza virus in swine, and all these studies have involved older virus isolates,” Richt said. “We are using present-day strains of the virus to study the effects in swine and poultry.”

The research is essential because avian influenza viruses can mutate and cause illness in humans and many other animal species. By improving vaccines, the researchers are protecting animal and human health while preventing a potential avian influenza pandemic.



Pandemic H1N1 and swine influenza

The researchers are studying how specific strains of the H1N1 virus affect swine populations and are addressing issues when some virus strains become drug-resistant.

By characterizing the pandemic H1N1 virus, the researchers are investigating the differences between the 2009 pandemic H1N1 and other H1N1 viruses, including the classical 1918-like H1N1 swine influenza virus.

They have found that the 2009 pandemic H1N1 virus is more easily transmitted in swine populations than the classical swine influenza virus. It is also easily sustained in swine populations, where it can mix and create new influenza viruses with genes derived from pandemic H1N1.

To prevent future swine influenza outbreaks, Richt and Ma are studying how the virus spreads and how to improve vaccines.

They are performing studies involving a detailed genetic analysis of the role of various gene segments of the 2009 pandemic H1N1 virus. They are studying how different genetic combinations affect the virulence and transmissibility of the pandemic H1N1 virus in mice and swine.

“We need to know what the genetic basis is for this virus being virulent and transmissible,” Ma said. “These are critical questions we need to answer.”

All of the projects involve several Kansas State University diagnostic medicine and pathobiology researchers, including: Derek Mosier, professor; Qinfang Liu, postdoctoral fellow; Bhupinder Bawa, research assistant professor; Wenbao Qi, visiting scholar; Huigang Shen, postdoctoral fellow; and Ying Chen, postdoctoral fellow. The projects involve funding and collaboration from a variety of organizations, including CEEZAD, the University of Washington, St. Jude Children’s Research Hospital and Mount Sinai School of Medicine.



By Jennifer Tidball, Communications and Marketing



Protecting the U.S. livestock industry

Researchers working at Kansas State University's Biosecurity Research Institute are combating an insect-transmitted disease that can be fatal to some animals, threatening the nation's agriculture economy.

They are investigating the biological relationships among exotic bluetongue virus, insects that transmit the virus and infected ruminant animals, which are grazing animals like sheep, goats and cattle. The researchers include Barbara Drolet, a research microbiologist with the Arthropod-Borne Animal Diseases Research Unit, or ABADRU, a unit of the U.S. Department of Agriculture's Agricultural Research Service, and a team from ABADRU. All of the researchers are also adjunct faculty members in diagnostic medicine and pathobiology at Kansas State University.

ABADRU studies livestock diseases to ensure safe agriculture products and to help sustain the agricultural economy. The USDA moved the unit from Laramie, Wyo., to Manhattan, Kan., in 2010 in part because the government researchers could conduct studies at the Biosecurity Research Institute. The move confirmed Manhattan as the international center for food safety and animal health research.

"The Biosecurity Research Institute plays a vital role in allowing researchers to safely study diseases that threaten livestock, crops and ultimately human health," said Ron Trewyn, vice president for research at Kansas State University. "Outside agencies have turned to the Biosecurity Research Institute for its unique capabilities. Other academic institutions, along with government and industry scientists, know that they can collaborate with Kansas State University, home to some of the world's leading experts in animal and plant diseases and in food safety and security."

Researchers are studying how exotic bluetongue virus interacts with insects and animals at the institute. The facility provides isolated and secure high containment labs and allows scientists to safely study all three components of arthropod-borne livestock diseases: the viruses, the insects that transmit them and the animals they infect.

The research provides a better understanding of the genetic and immunological factors that make animals susceptible to the disease.

Bluetongue virus can kill sheep and other ruminant animals. Midges, which are small biting flies, spread the disease when they bite an infected animal and pass it to another animal.

About 26 bluetongue viruses exist, and the disease is found everywhere in the world except Antarctica. More outbreaks are expected as temperatures continue to increase throughout the world. Bluetongue virus is a constant threat to America's livestock.

"Although this disease does not affect humans, an outbreak would have a catastrophic effect on our economy and trade with other countries," Drolet said. "This research will help protect farmers and their animals."

The name — bluetongue virus — derives from the fact that in severe cases, swelling in the head and neck can cut off circulation to the tongue, turning it blue.

ABADRU researchers include Lee Cohnstaedt, Scott D. McVey, Dana Nayduch, Mark Ruder and William Wilson. They are collaborating with Kansas State University and Colorado State University.

By Trevor Davis, Communications and Marketing



*Institute helps researchers develop
detection tools for deadly swine diseases*

The background of the lower half of the page features a collection of pig silhouettes in various shades of brown and tan. The silhouettes represent different pig breeds, including a large boar with prominent tusks, several smaller pigs, and a piglet. They are arranged in a way that creates a sense of a diverse pig population.

Going whole hog

Major breakthroughs in swine disease research from Kansas State University's Biosecurity Research Institute have underscored the institute's relevance in infectious disease research both today and in the future.

"The Biosecurity Research Institute isn't just changing research at our university, but everywhere," said Raymond "Bob" Rowland, professor of diagnostic medicine and pathobiology at Kansas State University's College of Veterinary Medicine. "The institute is a university resource, but it's also known as a worldwide resource."

Rowland is working with Richard Hesse, associate professor of diagnostic medicine and pathobiology and director of diagnostic virology at the university's Veterinary Diagnostic Laboratory. Together they are further developing the safe detection of infectious diseases.

Rowland and Hesse are using a swine oral fluids test for infectious disease agents like the classical swine fever virus and pseudorabies. Not only is the test noninvasive, but the method for collection makes it easy to get samples from up to 30 pigs at a time.

Rowland said that most of the material in oral fluids is saliva, but blood vessels lining the tissue of the pig's mouth can leak, allowing a sample to be taken.

"When you collect an oral fluid sample, you throw a rope into the pen and the pigs fight over it," Rowland said. "We get a sample that represents a population of pigs. This is one of the new revolutions in surveillance. The work we're doing at the institute is developing the tools needed to detect high-consequence agents."

Rowland said that the research focuses on detection and surveillance, rather than symptoms. This research will help herds remain healthy and avoid disease.

Hesse and Rowland's upcoming research will revolutionize the science of swine disease detection and surveillance.

"The viruses we're using don't make pigs sick," Rowland said. "We're looking at the most sensitive levels of detection — viruses that establish low levels of replication. This new technology allows us to take a single oral fluid sample and test it simultaneously for as many as 50 different infectious disease agents."

As the technology for these tests is prepared, Rowland said the Biosecurity Research Institute also will play a major role in the next step in swine disease research: genetics.

"We've heard a lot about sequencing the human genome, now we're doing the same thing with pigs," he said.

The Biosecurity Research Institute will be imperative in genetic studies because of its capabilities for studying large herds. Rowland said they want to find genes that help pigs respond better to a vaccine as well as develop vaccines for diseases for which there are none.

"We look at the quality of the product," Rowland said. "If you eat meat, you want to make sure it's tender, flavorful and healthy. You have to breed in all of those qualities, and we want to make sure that when we breed in the good stuff, we don't accidentally breed in the bad."

The Biosecurity Research Institute was built to adapt to developing research. Recently, Rowland was part of a research team that discovered a genetic marker that identifies pigs with reduced susceptibility to porcine reproductive and respiratory syndrome, or PRRS. The disease costs the U.S. pork industry more than \$600 million a year.

This research was completed in a biosafety level-2 facility, and Rowland said it could be translated directly to the Biosecurity Research Institute's biosafety level-3 facility.

"That's going to be the ultimate power — doing something that no one else can do," he said. "When we look at what the institute is well suited for, we're headed toward genetics."



“It may not matter where the strain originated, but we need to follow the populations because the foreign and mutated strains of wheat blast could have different properties and consequently different sensitivities,” Barbara Valent said. “The discovery in Kentucky is not a game-changer, but it makes it more important that we are ready.”





Tracking a silent killer

A genetics race to protect America's food supply and economy

Kansas has been fortunate to avoid a major wheat disease outbreak. Barbara Valent is working to reinforce that good fortune with science.

Valent, a university distinguished professor of plant pathology, leads a team of Kansas State University and governmental scientists in a comprehensive project on *Magnaporthe oryzae*, or wheat blast fungus. Although the disease is concentrated in South America, it is highly infectious — accounting for 30 percent of Brazil's wheat crop loss in 2009. More favorable climate conditions could cause 100 percent crop loss, Valent said.

As the leading wheat-producing state in the U.S., Kansas contributes roughly 20 percent of the nation's total wheat production and \$20.6 billion to the American economy. A wheat blast outbreak in Kansas could decimate crops and inflate food prices.

Wheat blast was first observed in South America around 1985 and efforts have been made to keep it isolated from America's heartland. In 2011, however, a single wheat head that was infected with the fungus was discovered in Kentucky.

"The interesting thing is it was not an imported fungal strain from South America; it's native to the U.S.," Valent said. "What happened was a host shift in a rye grass pathogen, a disease closely related to wheat blast that can mutate into it. It's something we predicted could happen, and we're hoping that it was just a rare event and won't ever show up again because the consequences could be enormous."

Finding a needle in a wheat bushel

Valent is collaborating with Jim Stack and Bill Bockus, university professors of plant pathology; Christian Cruz, a plant pathology doctoral candidate from Ecuador; and Gary Peterson and Kerry Pedley, scientists with the U.S. Department of Agriculture's Agricultural Research Service.

Researchers are testing South American wheat blast strains on varieties of Kansas wheat in Kansas State University's Biosecurity Research Institute to identify which have the best and worst resistance.

Tests have revealed that Everest, currently a favorite variety of Kansas wheat producers, has one of the lowest resistances to wheat blast.

"We're going to need resistance for wheat protection," Valent said. "That means wheat breeders will need to incorporate resistance traits into these less resistant varieties. Unfortunately there is no magic bullet variety for resistance against wheat blast."

Additionally, Cruz leads resistance field tests in Bolivia, an area of South America highly prone to wheat blast. The more resistant wheat varieties identified in the Biosecurity Research Institute are being planted and studied in a natural, disease-prone environment. Field results correlate with lab results.

Cracking the code

Valent and colleagues are also comparing different strains of the fungus and their genomes, or their genetic blueprints.

Comparisons among 25 years of South American wheat blast strains have revealed a much more aggressive pathogen in the field today, Valent said. The result is fungal strains that do more damage and transmit easier.

Data will be used to develop diagnostics that can quickly identify the wheat blast pathogen and differentiate whether it is foreign or mutated from the rye grass pathogen.

"It may not matter where the strain originated, but we need to follow the populations because the foreign and mutated strains of wheat blast could have different properties and consequently different sensitivities," Valent said. "The discovery in Kentucky is not a game-changer, but it makes it more important that we are ready."



Barbara Valent

By Greg Tammen, Communications and Marketing



Biosecurity Research Institute

Kansas State University

A training hub

The Biosecurity Research Institute is becoming a recognized international resource for biosafety and biocontainment training



With advanced capabilities and innovative facilities, Kansas State University's Biosecurity Research Institute is helping universities, businesses and organizations prepare for work in biocontainment facilities.

"The multidisciplinary research, training and educational activities that exist at the BRI make it a truly unique facility," said Stephen Higgs, institute research director, university associate vice president for research and Peine biosecurity chair. "The capacity to work on diseases of plants, humans and other animals and pathogens that contaminate the food chain, all under one roof, is quite extraordinary."

With more than 10,000 square feet of training and education facilities, the institute is equipped with the latest technology and ample space for research presentations and meetings. Some of these facilities

include conference rooms with distance learning capabilities, a modern lecture hall and an integrated training suite, which is a combined classroom-laboratory for interactive learning.

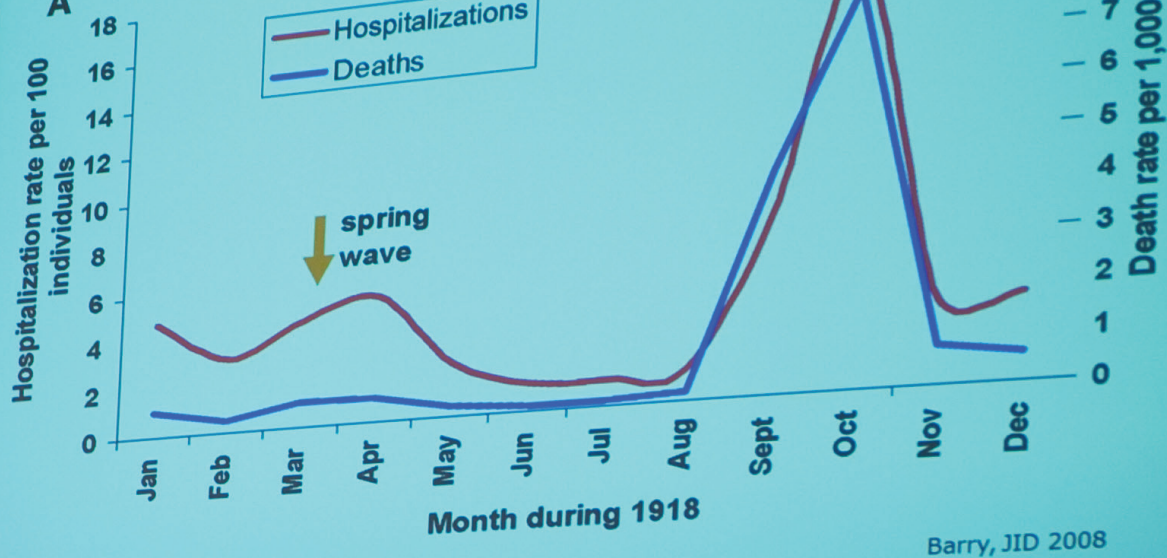
Because of these facilities, the institute is able to offer high-quality training opportunities on important topics including basic biosafety level-3 — or BSL-3 — practices, handling and identification of high-consequence pathogens, diagnosis of animal and plant disease, and containment facility operations.

"The ability to conduct hands-on training scenarios under the direction of biosafety professionals in a fully equipped laboratory promotes a critical safety culture for the institute," said Scott Rusk, who organizes training sessions and manages the facility operations as director of Pat Roberts Hall, home of the institute. "Conducting training

in the absence of hazardous biological materials allows research teams to practice and develop necessary skills that help them stay safe and secure in their workplace."

Through training sessions, the institute provides researchers with knowledge and experience specific to working in a BSL-3 facility. Since 2008 the institute has developed and offered 24 sessions of BSL-3 laboratory training, which is a required 30-hour training course for all staff, researchers, collaborators and scientists from outside agencies to enter BSL-3 laboratories. More than 100 participants — including research teams, BRI research support employees and the university's Comparative Medicine Group — have completed this training.

Kansas State University researchers who have trained for work in BSL-3 facilities are affiliated with either of two colleges: the College of Veterinary Medicine, including



Personnel from the following organizations have attended training sessions at the Biosecurity Research Institute as part of the National Biosafety and Biocontainment Training Program:



University of Puerto Rico



SoBran Inc.



University of Missouri



Novartis Research Foundation



Microbe Inotech Laboratories Inc.



Texas A&M University



U.S. Food and Drug Administration



Airtech Equipment, Singapore



Arkansas Livestock and Poultry Commission



Universidad Nacional Autonoma de Mexico



University of Nebraska - Lincoln



Purdue University



Battelle Memorial Institute

the department of anatomy and physiology, department of diagnostic medicine and pathobiology, and the Veterinary Diagnostic Laboratory; and the College of Agriculture, including the Food Science Institute as well as the department of animal sciences and industry and the department of plant pathology.

To make the training process effective, the institute developed an online pretest in 2009 for BSL-3 training and an online training needs assessment to identify appropriate training for specific employee and researcher roles.

Collaborative researchers also have been involved with training. These researchers are from outside organizations, such as Manhattan-based NanoScale Corp.; the University of Nebraska-Lincoln; Auburn University; and the Arthropod-Borne Animal Diseases Research Unit of the Center

for Grain and Animal Health Research, which is part of the Agricultural Research Service division of the U.S. Department of Agriculture.

National and international organizations have used the institute's training facilities as well. The National Biosafety and Biocontainment Training Program has conducted open training sessions at the institute, while institute staff have assisted with presentations to more than 13 universities and organizations. The USDA National Animal Health Laboratory Network has had high throughput robotics diagnostics training sessions at the institute for organizations from more than 20 states.

In recent years, the institute has expanded the training courses it offers. Administrators developed three training courses in 2009, seven training courses in 2010 and 17 training courses in 2011.

The institute also assists with emergency response training. In 2010, personnel presented special emergency training to more than 100 first responders, including the Manhattan Fire Department, Riley County Emergency Management Services and Mercy Regional Medical Center.

The institute has the additional potential to help train personnel who will work at the National Bio and Agro-Defense Facility, said Julie Johnson, biosafety officer who is in charge of internal biosafety and biosecurity training programs.

"We hope to expand our training capabilities in the future to address the biocontainment training needs of more campus departments as well as external customers," Johnson said.

By Jennifer Tidball, Communications and Marketing

Safety^{and} security by *design*

Multiple levels of safety protect those who protect us

Designed like a box within a box within a box within a box, Kansas State University's Biosecurity Research Institute provides multiple levels of safety and protection between pathogens that are being researched and the people who work with them.

"There is no single most important safety feature," said Julie Johnson, the institute's biosafety officer and assistant vice president for research compliance. "The combination of facility design, ongoing maintenance, safety equipment and thorough training of personnel are all necessary for safe operation."

Facility design and maintenance

Pat Roberts Hall, home of the institute, is constantly monitored by security. To keep the facility secure on the outermost level, the building is surrounded by a reinforced fence and it has identification badge scanners at entrances.

The building has a reinforced structure that makes it an ideal place to seek shelter during a tornado. It was built using federal guidelines for constructing community shelters, called a box-within-a-box design. Containment labs are inside the building's reinforced shell, and the backup power safeguards operation of the building's critical safety systems.

"The backup diesel generator will keep critical systems like air and waste-handling running at full capacity if there is an interruption of power, thus protecting the integrity of the research and keeping the community safe," said Scott Rusk, director of Pat Roberts Hall.

Inside, the building uses a directional airflow system with high-efficiency particulate air — or HEPA — filters. They filter the air coming into the building, inside containment labs and before the air is exhausted from the building. The system is constantly monitored and tested annually to confirm that each room's airflow is isolated.

"Since all the air that comes in to and out of the institute is HEPA-filtered, it is actually cleaner than it was when it came in," Johnson said. "It's a great place to work if you have allergies because the air is very clean inside containment."

Safety equipment

Each piece of lab equipment is consistent with the building's safety components. Biosafety cabinets, containment-specific clothing, personal respirators, showers and autoclaves are just a few of the many pieces of safety equipment frequently used inside containment.

Pathogens are only handled inside biosafety cabinets. These safety enclosures use HEPA filters and directional airflow to contain pathogens in the cabinet and prevent their release in the lab.

Personnel are issued personal respirators and special clothing. As they exit the lab, workers use an autoclave to disinfect everything before it can leave the lab, including clothing. Certain agents also require researchers to shower before leaving the lab.

All liquid waste from drains inside containment is sent to the effluent decontamination system before leaving the building. The tanks of the system, similar to oversized pressure cookers, decontaminate the liquid.

Solid materials used in research are disposed of in the alkaline tissue digester. The digester is similar to the effluent decontamination system in that it is like an oversized pressure cooker, but chemicals are added to raise the pH-level in order to break down tissues.

"When we say nothing leaves containment without being decontaminated, that means nothing: air, liquid, waste, equipment and people," Johnson said.

Training of personnel

The institute's comprehensive training program adds another safety level.

"How personnel work in a biocontainment facility is just as important as the physical biocontainment features of the building and safety equipment," Johnson said. "That's why it's important to have a robust, comprehensive, ongoing training program for personnel who work in biocontainment facilities."

Researchers and support staff are required to attend and pass an annual training course covering biocontainment design, safety equipment, medical surveillance issues, agent specific information, emergency response procedures and proper waste handling.

The training lab mimics everything researchers would do inside containment. They are given fluorescent or dyed liquid to simulate a microorganism. Purple smoke represents airborne pathogens in biosafety cabinets to monitor for disruption of the air curtain that keeps pathogens contained.

"In the training lab there is no risk, so researchers can practice and make mistakes," Johnson said. "Then they can keep practicing until they are able to work safely in the lab."

The multiple levels of protection, coupled with the ongoing training of personnel, make the institute an ideal location to safely perform research that will protect the nation's health and food supply.

"The biocontainment capabilities are unique and contribute to continued growth and leadership of Kansas State University in the areas of agriculture and public health," Rusk said.

By Stephanie Jacques, Communications and Marketing





The better to see *you* with

A white interior design aids insect, disease research



A room with white walls, white countertops, white cabinets and white lab coats is ideal for the work of Stephen Higgs, research director of the Biosecurity Research Institute, associate vice president for research and Peine biosecurity chair at Kansas State University.

The all-white room is the institute's new arthropod containment laboratory and will help scientists see small black insects easily — a must-have feature when working with insects smaller than one-eighth of an inch.

“The institute is a unique facility in what it can do because it has the ability to study plant pathogens, animal pathogens, food safety and security and now vector transmitted viruses,” Higgs said. “There are many viruses that we don’t completely understand the interaction among the three components of disease transmission: virus, vector and its vertebrate host.”

Once fully operational, the lab will be home to arthropods such as mosquitoes, ticks and biting flies called Culicoide midges. Arthropods are known to be carriers of many viruses, including bluetongue, the Schmallenberg virus, Rift Valley fever, West Nile virus, yellow fever virus and African swine fever.

The insect lab is a result of a collaborative funding and planning effort between the institute and the U.S. Department of Agriculture’s Arthropod-Borne Animal Diseases Research Unit, or ABADRU, which recently relocated from Wyoming to Kansas. Scientists from both facilities will work together using the institute’s secure biosafety level-3 and biosafety level-3-agriculture capabilities to understand disease transmission.

“Having an arthropod containment laboratory at the institute allows us to examine the interaction of viruses with the arthropod vectors, as well as a specific arthropod’s ability to transmit viruses to animals — otherwise known as vector bite transmission,” said Barbara Drolet, research microbiologist with the Arthropod-Borne Animal Diseases Research Unit who will be working in the lab.

Little is known about transmission of the Schmallenberg virus. It causes abortion in sheep and

cattle, but so far it has only been documented in Europe, Higgs said.

“There are no other labs in this country that can perform large animal studies with these viruses at the same capacity,” Higgs said. “The way that the building is constructed and all of the protocols we have in place make this the safest place to perform this kind of research.”

To work in the insect lab, researchers must go through rigorous training. This includes Higgs, who has studied vector-transmitted viruses since 1985.

Part of the training specific to working with insects is counting.

“Everything we do in the laboratory has been well rehearsed with uninfected insects,” Higgs said. “Even simple things such as counting are critical because we must account for all of our insects at all times. The rule is simple: If at the end of an operation you ended up with 99 instead of 100, then you would have to stay in that room until the missing one is found, no matter how long it takes. Facility construction, operating procedures and personnel training ensure safe and secure research.”

Although all insects are contained within three separate containers — one inside another — to eliminate the possibility of an escapee, the room has added safety precautions. Two separate forceful airstreams blast any would-be escapee away from the door back into the center of the room, and handheld vacuums are available for transferring the insects. Low ceilings and the all-white color of the room make it easier to find and capture an insect in the highly unlikely event that one did get out of a carton, Higgs said.

“The establishment of the arthropod lab at the Biosecurity Research Institute facilitates collaborative work, giving Kansas State University a competitive advantage over many academic institutes,” Higgs said. “It also benefits the nation in preventing or limiting viruses from infecting our country because the more we know the less vulnerable we are.”

By Stephanie Jacques, Communications and Marketing

The RIGHT mix

Many collaborators focused on common research goal

Whoever said that too many cooks in the kitchen will spoil the broth was obviously not a scientist.

As countries continue to document outbreaks of emerging plant and animal diseases, economists estimate that mixing these infectious pathogens with America's heartland could decimate the agricultural industry and cost the U.S. billions of dollars. That potential recipe for disaster is one that scientists and collaborators with Kansas State University's Biosecurity Research Institute are working to prevent.

"Collaboration is the key to success in addressing complex infectious disease questions," said Scott Rusk, director of Pat Roberts Hall — the home of the Biosecurity Research Institute. "Individual efforts are rarely matched by those of collaborations. Multiple collaborators represent diverse backgrounds, perspectives and technical approaches to enhance the discovery process and expedite conclusive research results."

The research facility currently houses biosafety level-3 and biosafety level-3-agriculture projects from five university departments, while scientists and researchers in other departments are also contributing data and developing technologies and techniques that support the various studies at the institute.

Several outside research organizations are also utilizing the facility.

For example, the U.S. Department of Agriculture's Arthropod-Borne Animal Diseases Research Unit uses the containment labs for projects to study Rift Valley fever and bluetongue disease. Also, the Center of Excellence for Emerging and Zoonotic Animal Diseases is creating vaccines for high priority animal diseases that can spread to humans, like highly pathogenic avian influenza and the pandemic H1N1 virus.

Others, such as the U.S.-China Center for Animal Health, are using the institute's findings in animal disease to accelerate the U.S. and Chinese animal health industries.

Projects are funded by multiple in-state and federal organizations, such as the National Institutes of Health, U.S. Department of Agriculture, U.S. Department of Homeland Security, and the Kansas Bioscience Authority — all of which have a vested interest in stopping diseases.

In addition to its U.S. collaborators, several of the institute's researchers are planning for future collaborations with international scientists.

In April, Kansas State University began a six-year research collaboration with the Australian Plant Biosecurity Cooperative Researcher Centre — a consortium among several of Australia's leading governmental research intuitions and universities. Researchers will study and develop solutions for emerging plant diseases and insect pests that threaten U.S. and Australian agricultural systems, as both countries share similar agriculture. Projects will be conducted in the Biosecurity Research Institute because Australian policy prohibits foreign diseases from entering the continent — even for research purposes.

Using the unique combination of capabilities at the Biosecurity Research Institute is critical to stopping these infectious diseases throughout the world and protecting the United States.

By Greg Tammen, Communications and Marketing



The following scientists and organizations collaborate at the Biosecurity Research Institute to find common threads with animal and infectious plant disease research:

International:

- U.S.-China Center for Animal Health

National:

- Arthropod-Borne Animal Diseases Research Unit
- Center of Excellence for Emerging and Zoonotic Animal Diseases
- National Agricultural Biosecurity Center
- National Animal Health Laboratory Network
- National Institutes of Health
- Plum Island Animal Disease Center
- U.S. Department of Agriculture
- U.S. Department of Defense

- U.S. Department of Homeland Security
- U.S. Army Natick Soldier Research, Development and Engineering Center

State:

- Kansas Bioscience Authority
- NanoScale Corp.

University:

- Veterinary Diagnostic Laboratory, College of Veterinary Medicine
- Comparative Medicine Group, College of Veterinary Medicine
- Kansas State University's Colleges of Agriculture and Veterinary Medicine; departments of animal sciences and industry, anatomy and physiology, clinical sciences, diagnostic medicine and pathobiology, and plant pathology.

For the Biosecurity Research Institute, collaborators — both on campus and off — are involved in expediting solutions for controlling plant and animal diseases.



William Wilson, Arthropod-Borne Animal Diseases Research Unit

Scientists working at Kansas State University's Biosecurity Research Institute aren't just studying the disease-causing pathogens threatening the health and food supply of the nation today — they are also training the next generation of researchers in the field.

Several Kansas State University students are earning opportunities to assist with the institute's research projects and enhance their career prospects.

Just as faculty must do, these students must also complete a rigorous training process before entering the institute. Raymond "Bob" Rowland, a virologist and professor of diagnostic medicine and pathobiology, maintains laboratories in the Biosecurity Research Institute and the College of Veterinary Medicine. His college laboratory employs around 20 students and is a good indicator of those capable of the institute and the research.

"Many of the undergrads who work for me do so for three or four years," he said. "After four years they have an incredible amount of experience. They're capable of working in containment, provided they can handle all of the training."

Limitations still exist for students in the Biosecurity Research Institute. Rowland prohibits student researchers from working with agents that could infect humans.

Benjamin Tribble, doctoral candidate in diagnostic medicine and pathobiology, has benefited from Rowland's willingness to permit properly trained students to participate in research. Tribble began working with Rowland in 2006 as an undergraduate and advanced to research in the institute, where he assisted with the development of a vaccine for swine disease. His experiences were so positive that they had a bearing on his career plans.

"When I began working with Dr. Rowland, I was premed," Tribble said. "But working in virology lit a fire for me. I was going into the field and seeing clinical cases. I like genetics and I like research in the laboratory. That was the shift that led to virology."

Tribble currently works in both of Rowland's laboratories. In addition to working with Rowland, he also works with the undergraduates and uses his own experiences and knowledge to inspire the future researchers.

"I believe that working with the undergraduate students has cemented what I'll be doing in the future," Tribble said. "I really enjoy teaching the undergraduate students and I believe that's what I want to do with the rest of my life — teach and do research."

Also ascending from lower-security level laboratories to the institute is Donka Milke, master's student in food science and industry.

A transformative experience

Students find career paths by assisting with research in the Biosecurity Research Institute



As an undergraduate, Milke conducted research with Randall Phebus, professor of animal sciences and industry, in his laboratory in Call Hall, beginning in 2010. Not long after, Phebus began training Milke for research in the Biosecurity Research Institute.

Milke assisted Phebus in the Big Grind project, which studied the distribution of food-borne pathogens in ground beef during the manufacturing process.

Milke's experiences at the institute have played a major role in her future. She plans for a job in food safety after receiving her master's degree.

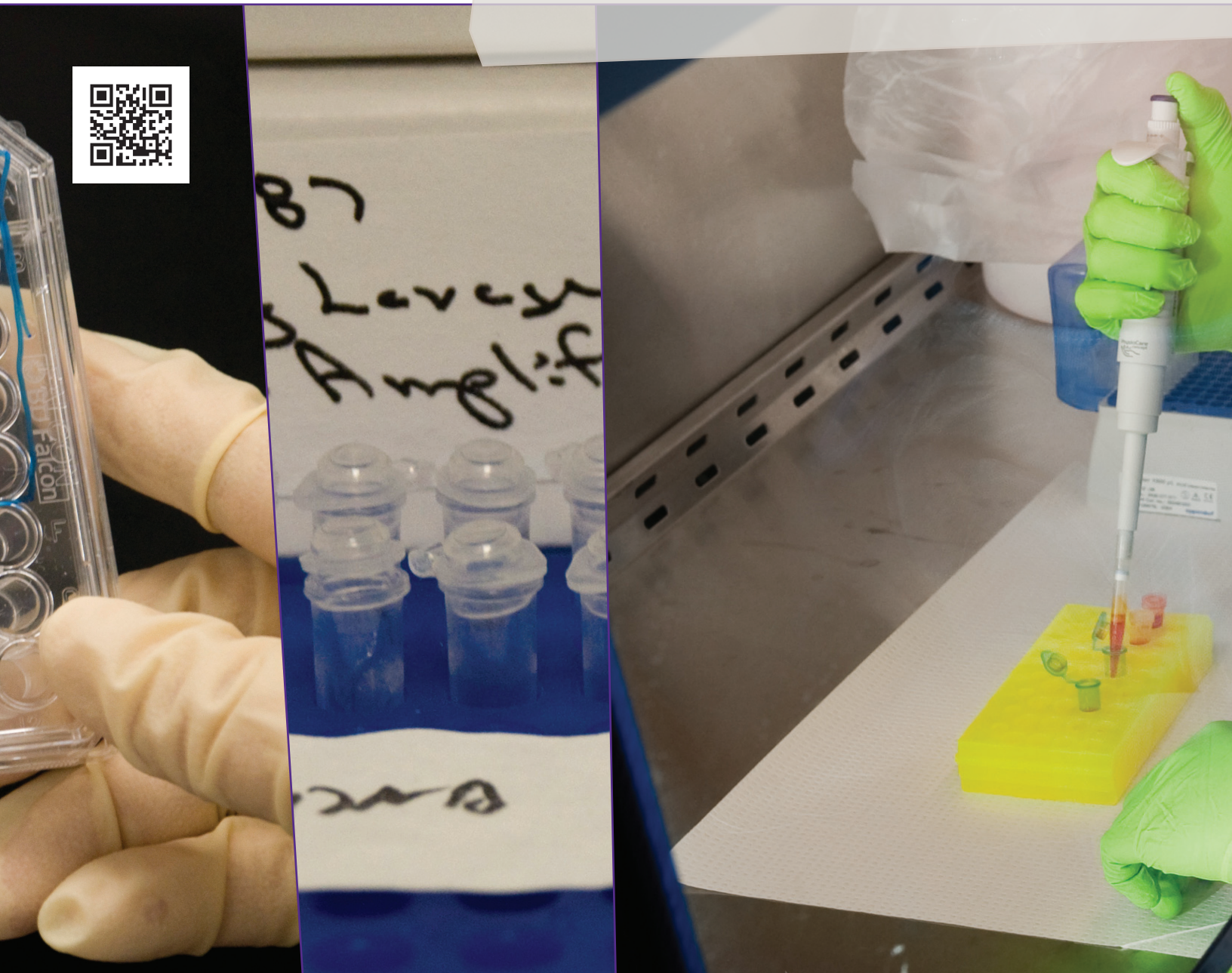
"I'm extremely glad that I have been able to be a part of the Biosecurity Research Institute, even if it was briefly," Milke said. "For an undergraduate student such an experience can be a steppingstone and help you decide your career path. This has been an important deal for me."

By Tyler Sharp, Communications and Marketing

Student researcher training process

Before working in the Biosecurity Research Institute, students must:

- + Complete a three-day training course featuring significant information on processes, procedures and laboratory protocol.
- + Finish a hands-on training session to prove they are comfortable working in a laboratory-type setting.
- + Pass a background check.
- + Complete any additional requirements determined by the researcher.
- + Complete training annually.





Stephen Higgs

As research director of the Biosecurity Research Institute, associate vice president for research and Peine biosecurity chair, Stephen Higgs is strengthening existing

research programs and developing new opportunities for future research at the institute. With the university's 2025 Visionary Plan in mind, Higgs is helping the institute become internationally recognized for research on animal and plant diseases, food safety and security, and related public health issues.

He has a doctorate in ecological parasitology from Reading University and a bachelor's in zoology from King's College, both in the United Kingdom. He has worked for infectious disease laboratories at Colorado State University and the University of Texas Medical Branch. From 2005 to 2011, he was director of the Center for Biodefense and Emerging Infectious Diseases at the University of Texas Medical Branch – a biosafety level-3 insectary.

"An important aspect of the Biosecurity Research Institute to Kansas State University is that it has a unique combination of multidisciplinary research and educational capabilities all under one roof," Higgs said. "Since these are available to faculty, staff and students from many departments and colleges, we can facilitate collaborative work that can give the university a competitive advantage over other academic institutes when we apply for grants and contracts."



Julie Johnson

With safety as her first priority, Julie Johnson is the Biosecurity Research Institute's biosafety officer, assistant vice president for research compliance

and responsible official for the campus select agent program. She coordinates animal care and manages laboratory support services to ensure that the institute and university are compliant with all safety regulations and guidelines. She also coordinates annual biosafety and biosecurity training programs for personnel and support staff at the institute.

Johnson has a doctorate in molecular, cellular and developmental biology and a master's in biochemistry, both from Iowa State University. She received her bachelor's in chemistry from St. Olaf College in Northfield, Minn., and she is a certified biological safety professional by the American Biological Safety Association. She worked for Iowa State University as the responsible official for select agent use from 1997 to 2006 and as the biosafety officer from 1996 to 2006.

"A lot of forethought goes into designing an infectious disease lab like the Biosecurity Research Institute," Johnson said. "One of the ideas that makes the institute different from a non-containment lab is our annual training program. You can't engineer out human mistakes, but if you continuously train people it will help. We're really fortunate to have the training lab that we do."



Scott Rusk

As director of Pat Roberts Hall – home of the Biosecurity Research Institute – Scott Rusk is responsible for the policy and management of biocontainment

facilities in support of the institute's infectious disease research programs.

He has a master's degree in veterinary microbiology and preventive medicine from Iowa State University and a bachelor's in biology from the University of Northern Iowa. He was associate director and operations manager at the institute from 2006 to 2007; the biocontainment operations and management specialist at Flad Architects from 2003 to 2006; and assistant director of the U.S. Department of Agriculture's National Animal Disease Center, Ames, Iowa, from 1999 to 2003, where he also served as director of environmental health and safety from 1992 to 1999.

"The Biosecurity Research Institute provides new opportunities for enhanced research programs at the university," Rusk said. "The biocontainment capabilities are unique, which contribute to continued growth and leadership in the areas of agriculture and public health."