Kansas State University

Perspectives

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

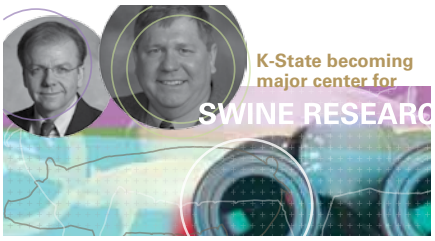
Welcome to the first issue of our new research magazine. This inaugural issue focuses on the Biosecurity Research Institute and the National Bio and Agro-defense Facility. The Department of Homeland Security's selection of Manhattan and K-State as home to the National Bio and Agro-defense Facility impacts the university, the community, and the state in a myriad of positive ways.

In announcing the decision by the Department of Homeland Security to build the nation's premier laboratory for plant and animal disease research, U.S. Senator Pat Roberts said DHS was making one of the most significant investments in the Kansas economy in state history. He noted that Kansas will cement its reputation as the nation's leader in plant and animal health research and the biosciences. And Kansans will reap the benefits of a cutting-edge industry while protecting the nation's food supply and agricultural economy for years to come.

K-State also gains from the exceptionally talented scientists who will work at the NBAF, many of whom will become adjunct faculty members. The Manhattan community already is benefiting from NBAF with national chains frequently contacting the Manhattan Chamber of Commerce to discuss locating stores in the city.

The BRI is a key component in K-State's goal to be recognized as one of the nation's Top 50 Public Research Universities by 2025. The university's work in the biosciences and animal health will be a key factor as K-State moves upward to new heights of achievement.

We invite you to read about how Kansas State University is making a difference by ensuring the safety of our nation's food supply.



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Six K-State professors receive more than **$3.5 million** in National Science Foundation CAREER awards

Christine Aikens

Jianhan Chen

Kendra McLauchlan

Simon Ou

Anna Whitfield

Wenqiao "Wayne" Yuan

When the news was announced Kansas State University had not one, or two, but six faculty members whose research was recognized by the National Science Foundation, it was not only a cause for celebration, but a historic first for the university.

The Faculty Early Career Development Program, or CAREER, award is one of the nation's most prestigious honors directed toward young faculty in recognition of their high potential to become future leaders in their research areas.

"When talking with past winners of CAREER awards, I am always amazed at the profound impact that the award has had on their professional lives at K-State," said Jim Guikema, associate vice president for research.

Guikema said he hopes the same is true for the current six.

This year's winners are Christine Aikens, assistant professor of chemistry; Jianhan Chen, assistant professor of biochemistry; Kendra McLauchlan, assistant professor of geography; Simon Ou, assistant professor of computing and information sciences; Anna Whitfield, assistant professor of plant pathology; and Wenqiao "Wayne" Yuan, assistant professor of biological and agricultural engineering.

Combined, the researchers netted more than $3.5 million in funding.

Christine Aikens

Assistant professor of chemistry
$600,000 over four years

Chemist Christine Aikens, who joined K-State in 2007, will use the award to improve the laboratory experience for students and conduct research that could lead to clean and renewable sources of energy. Aikens is the fourth recipient from K-State's chemistry department to receive a CAREER award.

A portion of her four-year award will go toward molecular modeling software in the K-State student chemistry laboratories. In addition, Aikens will offer annual energy and sustainability workshops for middle school students to study solar power, biological energy and other renewable energy and materials. The rest of the award will go toward Aikens' study of the complex photosystem II, where she and her research group will analyze the protein and why its oxygen-evolving center makes it an effective catalyst for water splitting.

Aikens earned a bachelor's degree from the University of Oklahoma in 2000 and a doctorate from Iowa State University in 2005. She was a postdoctoral research fellow at Northwestern University before joining K-State in 2007.

Jianhan Chen

Assistant professor of biochemistry
$670,000 over five years

K-State professor Jianhan Chen will use his award to develop new methods for effective modeling of proteins and to study functional proteins, research that is frequently involved in human diseases like neurodegenerative disease and cancer. Additionally, Chen will use his award to lead two-day summer workshops on biomolecular modeling tools and training projects for high school and college instructors.

Chen earned a bachelor's degree from the University of Science and Technology of China and a master's degree and doctorate from the University of California at Irvine. He was a postdoctoral researcher at the Scripps Research Institute in La Jolla, Calif., before joining the K-State faculty in 2007. He was named a K-State Wakonse Fellow in 2009 and has earned two Innovative Research Awards from K-State's Terry C. Johnson Center for Basic Cancer Research.

Kendra McLauchlan

Assistant professor of geography
$440,000 over five years

Geographer Kendra McLauchlan's NSF grant won't buy her a time machine, but it will help her and her team examine data from 10,000 years ago. She will use her award to study contrasts in vegetation history to reconstruct past nitrogen cycling and other ecosystem properties. She will research data from a prairie site, a forested site and a transitional site in increments of 10, 100, 1,000 and 10,000 years. Her research will be made public in an interactive display in the Itasca State Park visitor's center in Park City, Minn., as well as available in modified online modules.

McLauchlan directs K-State's Paleoenvironmental Laboratory, and she has been a part of three other NSF grants at K-State, including two for which she is principal investigator or co-principal investigator.

McLauchlan earned a bachelor's degree from Carleton College and her master's and doctorate degrees in ecology from the University of Minnesota. Before coming to K-State, she was a postdoctoral fellow at Dartmouth College.

Simon Ou

Assistant professor of computing and information sciences
$430,000 over five years

Professor Simon Ou is a soldier in the war against cyber attacks, and a recent five-year NSF CAREER award will be put toward further defense for weak links in cybersecurity. With his project, "Reasoning under Uncertainty in Cybersecurity," Ou hopes to improve cybersecurity by creating automated reasoning for network administrators. K-State undergraduate students and the general public will also benefit from Ou's research through outreach programs on the problems of cybersecurity.

Ou earned a doctorate in computer science at Princeton University, and then served as a postdoctoral research associate at Purdue University's Center for Education and Research in Information Assurance and Security and as a research associate at Idaho National Laboratory. He earned bachelor's and master's degrees in computer science from Tsinghua University in Beijing.

Anna Whitfield

Assistant professor of plant pathology
$1 million over five years

Professor Anna Whitfield will use her five-year grant to study how virus-carrying insects respond to the viruses themselves. Whitfield hopes to develop an interactive exhibit for K-State's insect zoo to help educate the public about her research. Additionally, she plans to prepare teaching tools for middle school science teachers to incorporate virology into their lesson plans, as well as to mentor undergraduate students from underrepresented groups.

Whitfield earned a bachelor's degree in biological science at the University of Georgia, a master's degree in plant pathology at the University of California, Davis, and a doctorate in plant pathology at the University of Wisconsin. She is an ancillary faculty member in K-State's department of entomology.

Wenqiao "Wayne" Yuan

Assistant professor of biological and agricultural engineering
$400,000 over five years

Wenqiao "Wayne" Yuan's efforts to reduce the costs of algae oil production won him a five-year CAREER grant for his project, "Multi-scale Structured Solid Carriers Enabling Algae Biofuels Manufacturing in the Ocean." Yuan hopes that his research will make energy manufacturing from algae economically viable, and he hopes to identify what the best large solid carriers are — like thin sheets of metals or polymers — as well as which surface textures, such as smooth or dimpled, are best for algae growth.

Yuan, in collaboration with Zhijian "Z.J." Pei, a professor of industrial and manufacturing systems engineering at K-State, was previously awarded a $120,000 NSF grant in 2008 for their work on a related study.

Yuan joined K-State in 2006 and has research interests in biofuels and bioproducts. He earned his bachelor's and master's degrees from China Agricultural University and a doctorate from the University of Illinois at Urbana-Champaign.

Federal lab to boost K-State 2025 initiative

As the National Bio and Agro-defense Facility building rises, so will Kansas State University's reputation.

The $650 million federal facility, set to open in 2016 at the northern edge of campus, will play an important role in K-State President Kirk Schulz's goal to become a top 50 public research university by 2025. The Department of Homeland Security lab, which develops vaccines and countermeasures for diseases threatening animals, will attract some of the world's top animal health researchers, lead to more collaboration among scientists regionally and nationally, and help K-State meet the standards to become a top 50 public research university.

Schulz's K-State 2025 vision is an aggressive plan to boost the university's stature among the country's most distinguished and respected universities in the next 15 years.

"The arrival of NBAF will help bolster K-State's prestige and standing," Schulz said. "It's critical that we take advantage of this opportunity to further strengthen the university's reputation as we become a top 50 public research university."

The rankings — and more important, the data backing them — will assist in the recruitment and retention of top students, faculty and staff, and they will help students applying for jobs and graduate schools, doctoral students searching for careers as researchers, and faculty members competing for research funding, Schulz said.

Schulz and April Mason, provost and senior vice president, along with members of the president's cabinet, chose eight categories to measure progress and determine K-State's current ranking. In most categories K-State ranks between 80 and 90 in comparison to other public research universities, which means K-State will have to climb roughly 35 spots against other schools also trying to increase their rankings. Categories include:

- Total research and development expenditures
- Total endowment
- Number of national academy members
- Number of faculty awards (as defined by the Center for Measuring University Performance at Arizona State University)
- Number of doctorates granted annually
- Freshman-to-sophomore retention rate
- Six-year graduation rate
- Percent of undergraduate students involved in research

NBAF will boost K-State's research efforts, a key factor in the 2025 initiative, said Ron Trewyn, K-State's vice president for research. The facility could also increase research dollars by attracting more scientists to Manhattan.

"It will allow us to grow our expertise in the food science and animal research realm, and in turn, that will grow our funding dollars from the National Institutes of Health, National Science Foundation and other federal agencies," he said.

"This kind of facility right next to us gives us an opportunity for collaboration and partnership that isn't possible without that proximity. A lab many states away can be a collaborator, but NBAF being right here at K-State will make it that much more accessible and available for collaboration."

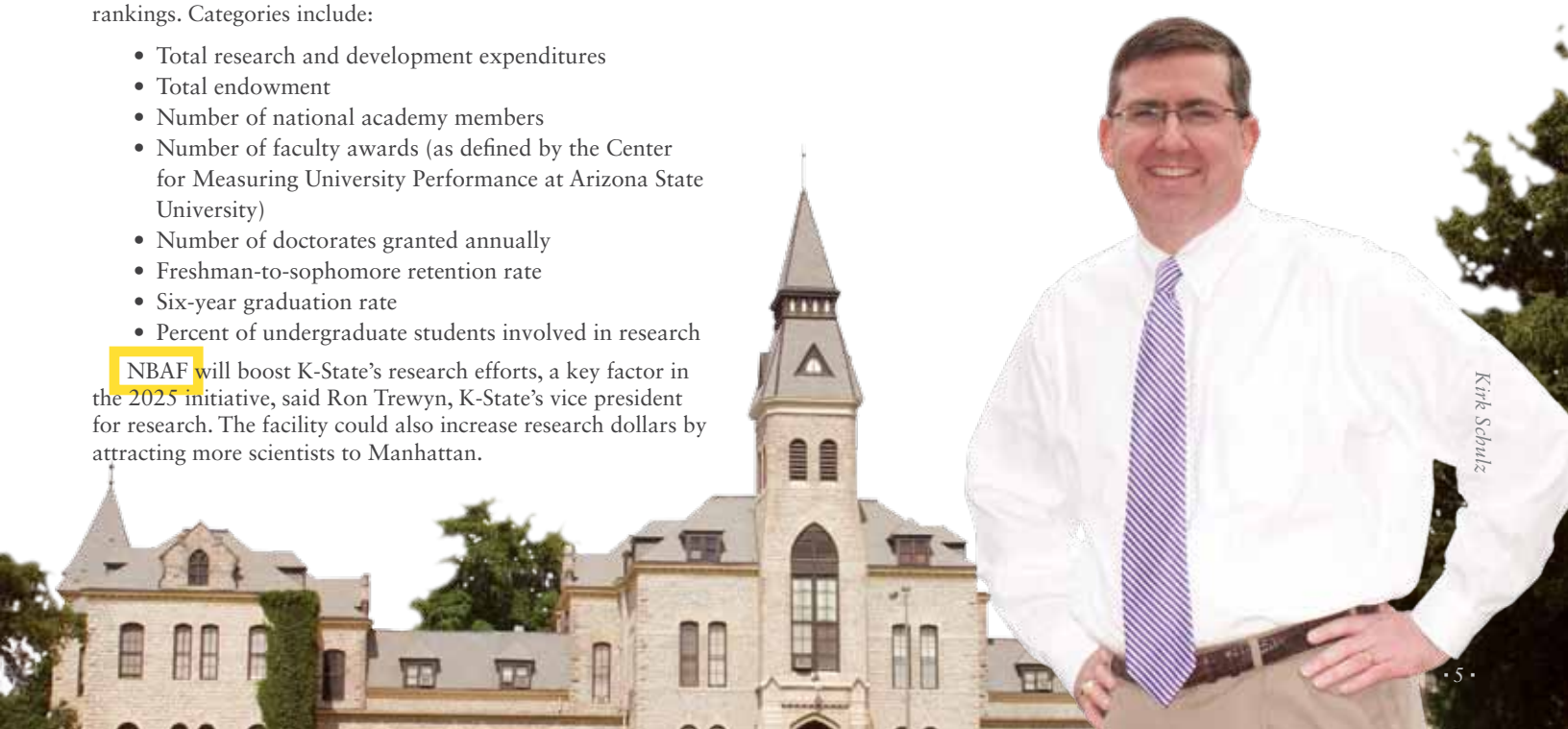
Faculty will also be able to partner with NBAF researchers, Mason said.

"Faculty are always looking for ways that they can be enriched with different lab facilities and various viewpoints from different colleagues," Mason said. "None of us operate in a vacuum; we need colleagues and others around us with whom we can collaborate, write, discuss and conduct research."

Although NBAF's opening is several years away, the process to bring the federal lab to Manhattan puts K-State in the national spotlight. The Department of Homeland Security wanted to build the lab in an area with high levels of research, and K-State is known for its expertise in livestock medicine, food science and infectious diseases.

"NBAF's location really builds on K-State's strengths of animal health and food science research, and we wouldn't have been competitive for NBAF if we didn't already have those assets," Trewyn said. "In short, NBAF will solidify K-State as the world's animal health research center."

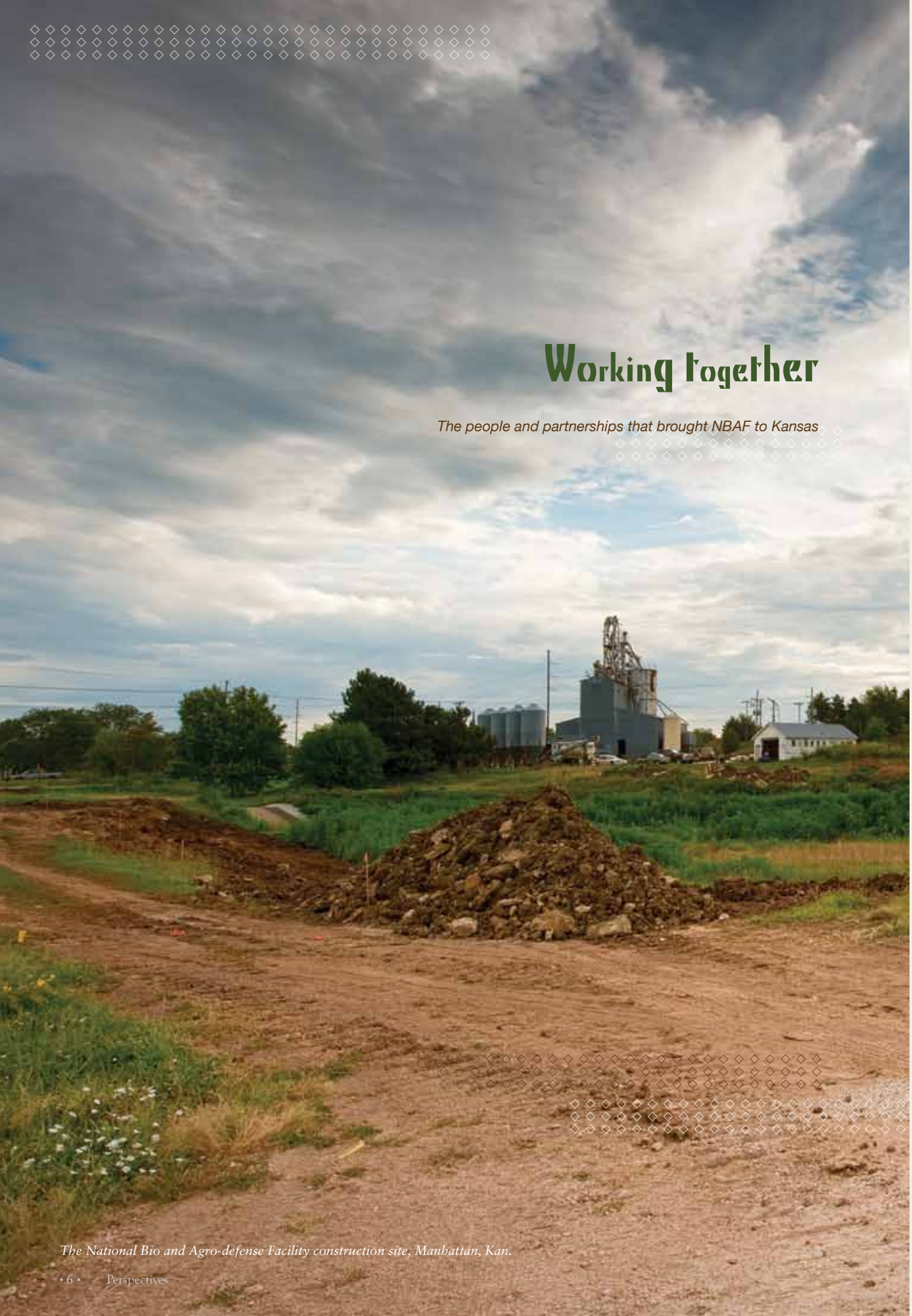
By Trevor Davis, Communications and Marketing



Kirk Schulz

Working Together

The people and partnerships that brought NBAF to Kansas



The National Bio and Agro-defense Facility construction site, Manhattan, Kan.

"Our guess was that the Department of Homeland Security wanted the consortium to have the sort of expertise that would be needed for various infectious disease threats, and so we got together with the Kansas City Area Life Sciences Institute, the Midwest Research Institute, the Animal Health Corridor and essentially got every research university in a 300-mile radius to be a part of the Heartland BioAgro Consortium. Our belief was if the selection was done on the merits of the community, **we were going to win.** And we moved forward with that expectation."

— Ron Trewyn, Kansas State University vice president for research

If it takes a whole village to raise a child, then it takes a whole region to acquire and support the National Bio and Agro-defense Facility. It also took an intricate combination of local leaders, research universities, bioscience organizations and politicians coming together with one goal in mind: Get NBAF to Kansas.

When the Department of Homeland Security announced its search for a location to replace the aging Plum Island facility in 2006, Kansas State University Vice President for Research Ron Trewyn and his research team knew creating a massive web of partnerships would be the only way Manhattan, Kan., would have a shot at winning. And so the Heartland BioAgro Consortium task force was born.

The Heartland BioAgro Consortium submitted proposals for two Kansas locations: Manhattan and Leavenworth. Both sites made it to the final 17, and if the Department of Homeland Security had not determined that there could be only one finalist per state, Leavenworth would have joined Manhattan in the final five. It was this partnership that stood out to the reviewers, Trewyn said. Instead of competing against each other, representatives from Manhattan and Leavenworth supported each other, realizing the benefits and opportunities NBAF would bring to the entire region.

Sen. Pat Roberts, Gov. Mark Parkinson, former Gov. Kathleen Sebelius, Kansas Farm Bureau, the Kansas Livestock Association, dozens of scientists, scholars and both local and regional executives rounded off the list of more than 50 task force members. But it was the partnerships in Manhattan that were at the epicenter of the two-year push to get NBAF.

It was this synergy that brought the $650-million, 500,000-square-foot facility to Manhattan, and it will be that same synergy that keeps enthusiasm and support thriving — even though NBAF will not be up and running for at least five years.

As Manhattan evolves to fit NBAF and brings the ensuing wave of scientists and up to 40 additional businesses and laboratories into an already bustling community, these close relationships continue to grow. One such partnership was forged between Manhattan Area Technical College, K-State and the city of Manhattan. When word about the NBAF proposal got around, MATC President Rob Edleston realized that there was something missing.

"The 100-to-1 support staff that you may need for one major scientist — all those technicians, the receptionists and everybody else — the planning committee really didn't think about that," Edleston said. "K-State's job is to create the scientists, but somebody sets up and keeps track of those experiments, somebody washes all those pipettes, and somebody is working the midnight shift — those are our graduates."

And so MATC, with the support of K-State President Kirk Schulz and various other leaders in the region, was recently granted a $366,000 loan from the city of Manhattan to jumpstart a lab technician program that will enhance and complement future NBAF and K-State experiments. Edleston has estimated that with this loan, the resulting local lab tech graduates will bring Manhattan about $20 million in 10 to 12 years. Courses are slated to begin in January 2011, with the full curriculum going into effect by that fall.

The community has more than cooperated in recent years for various other projects, like the expansion of Fort Riley, the re-establishment of jet service out of the Manhattan Regional Airport and the planning and construction of the new Flint Hills Discovery Center, said City Manager Ron Fehr.

"We've been fortunate to have good partnerships here in Manhattan, even before NBAF, and it really helped us cultivate that partnership coming together and expanding even more," Fehr said.

It's projects like these that keep excitement high for the facility that will have a lifespan of at least 50 years once it opens in five years. Although it will be a while until NBAF becomes a physical reality beyond the sign that marks the construction site, it's clear that the partnerships that got NBAF here will only strengthen through 2016 and beyond.

"Everyone who has a stake in this state came together. At the local level in Manhattan, there certainly has been a synergy of support among the units of government, city and county. There was synergy for NBAF; there is an existing synergy in the community; and Manhattan was a strong partner in that statewide effort to win NBAF."

— Bruce Snead, mayor of Manhattan, Kan.

By Rachel Skybetter, Communications and Marketing

Good news for the local economy

More jobs are coming to Manhattan, Kan.

The national unemployment rate may be staggering, but employment opportunities are about to balloon in Manhattan, Kan. By the time the National Bio and Agro-defense Facility is open for business, it will employ about 350 people, reaching an eventual goal of about 500. But the number of jobs that will be created in Manhattan because of NBAF is much greater — and completely unpredictable.

When Manhattan was selected as NBAF's future home in January 2009, the calls immediately started pouring in from companies anxious to make their mark on what will become the nation's center of animal and agricultural health.

"The announcement triggered lots of phone calls from all kinds of different companies — from pharmaceutical companies to animal science research companies," said Lyle Butler, president and CEO of Manhattan's Chamber of Commerce. "They want to be where the action is, and the action for this kind of research is going to be here in Manhattan, so that has brought a lot of companies to say, 'When that gets built, we want to be there.'"

These companies, which cannot be named because it is too early in the planning stages, won't break ground for many years. Some only wish to rent office space, while others have expressed interest in building their own facilities, Butler said.

Of the 350 employees who will work at the 500,000-square-foot facility when it's slated to open in 2016, about 100 to 150 will be scientists and researchers with high salaries. The remainder will be support staff: lab technicians, maintenance workers and administrative support for NBAF, jobs that will be filled by Manhattan residents. Manhattan Area Technical College President Rob Edleston plans to expand the school's lab technician program to prepare graduates for the level of work NBAF and the 20 to 40 related companies expected to move to Manhattan will require. Courses are slated to begin in 2011.

"You're not going to have a lab tech move from Plum Island, where the current facility is located," Edleston said. "We're going to grow them here."

The scientists and researchers affiliated with NBAF and the surrounding laboratories will boast high-paying salaries, which will be funneled back into the local economy and real estate market, creating more jobs and businesses for Manhattanites.

"This facility and the 250 to 350 jobs that come with it are economic drivers in the community, and that's certainly one of the reasons we committed our economic development funds to winning NBAF," said Manhattan Mayor Bruce Snead.

The magnitude of how incoming researchers will impact Manhattan goes far beyond their scientific experiments.

"The folks who work at NBAF are going to buy cars and groceries, they're going to go to the movies, eat at restaurants and buy shoes," Butler said. "All of that helps businesses, and the more you have that, then the more other businesses you're going to attract to the region."

And those are just the people who will work inside the 500,000-square-foot facility. An estimated 1,500 to 1,600 construction workers will be in the city over the four- to five-year time period NBAF will be built, according to Kansas State University Vice President for Research Ron Trewyn. The majority of the contractors, construction workers, plumbers and electricians will hail from the region and will also utilize Manhattan's hotels, restaurants and retail stores.

Manhattan residents can expect to see a very different north side of town in the future as scientists flock to be closer to what will become the center of animal disease research, which will lead to more residences and commercial spaces being built.

"Researchers want to be as close as possible to the research that's going on at K-State, BRI and NBAF," Butler said. "In an ideal world, they would like to be able to walk across the street and collaborate with other researchers."

NBAF is expected to bring vast numbers of visitors from around the world, leading to the construction of at least two hotels and opening up the option for many restaurants and retail stores, but it's too soon to predict the scope of NBAF's effect locally.

"Manhattan is going to evolve and change over the next 20 years. It's not something that's going to happen tomorrow or next week," Butler said. "But for the quality of life of the community, there's going to be growth that will create very high-paying, good-quality jobs. I think Manhattan is a very fortunate community."

By Rachel Skybetter, Communications and Marketing

Juergen A. Richt

CEEZAD focuses on zoonotic diseases

Juergen A. Richt and other K-State scientists are zeroing in on zoonotic diseases, which are diseases that can be transmitted from animals to humans.

Richt and his team recently traveled to Morocco to investigate an outbreak of West Nile Virus in horses and to Mongolia to study outbreaks of foot and mouth disease in camels and sheep. K-State has an important role in the study of zoonotic diseases, thanks to the newly designated Center of Excellence for Emerging and Zoonotic Animal Diseases, or CEEZAD.

The Department of Homeland Security is funding the center, and Richt, a Regents distinguished professor at Kansas State University and a Kansas Bioscience Authority Eminent Scholar, will serve as the director.

The CEEZAD team will support research that will protect human and animal health and further boost K-State's reputation as a hub for animal health research. This cooperative agreement is $2 million per year for six years, totaling $12 million.

Although zoonotic diseases have existed for centuries, scientists want to better understand how diseases adapt and change. At least 60 percent of all human pathogens are zoonotic, according to the Centers for Disease Control and Prevention, and 75 percent of recently emerging infectious diseases that affect humans come from animals. Some of these diseases pose catastrophic risks to human health, livestock health and the agricultural economy.

CEEZAD will enhance the Department of Homeland Security's capabilities to protect America against agroterrorism caused by zoonotic infectious agents.

"We need to become alert to how agriculture can become a force for good or evil, depending upon the motives of those who have the competence and confidence in dealing with agricultural matters," Richt said.

CEEZAD scientists will conduct research, develop technology and train a specialized work force to defend U.S. pre-harvest agricultural systems against catastrophic events caused by emerging and zoonotic pathogens.

CEEZAD is partnering with the Foreign Animal and Zoonotic Disease Defense Center at Texas A&M University to co-lead the Department of Homeland Security's efforts to involve university researchers in zoonotic and animal disease detection. More than 30 universities and other partners around the world are also involved as collaborators. This partnership will unite research efforts in vaccines, detection and diagnostics, epidemiology and education and outreach.

By Trevor Davis, Communications and Marketing

The USDA Tower, Manhattan, Kan.

Proximity to research is one of the major reasons Manhattan, Kan., was selected as the new site for the National Bio and Agro-defense Facility.

That research is not limited to the university community, but also extends to federal facilities such as the Agricultural Research Service's Center for Grain and Animal Health Research. Scientists at this facility frequently collaborate on projects with faculty and staff from various Kansas State University departments.

Ron Trewyn, vice president for research at K-State, believes the center and the university have a great relationship. "We are trying to build a model for how the USDA and a university can work together," he said.

For more than 90 years the facility has been represented in the Manhattan community as part of the U.S. Department of Agriculture's Agricultural Research Service.

Today the facility includes five research units and a staff of about 100 employees and 30 to 40 scientists. Each of the scientists is working on a research project linked to federal or state scientists in other locations, according to Tom Shanower, agricultural administrator for the center. Additional projects are being conducted with K-State scientists. The varying research projects and partners show the multifaceted approach of the Center for Grain and Animal Health Research in action, an approach that is improving lives worldwide.

Arthropod-Borne Animal Disease Research Unit

The center's newest unit, relocated to Manhattan from Laramie, Wyo., in July 2010, works on diseases carried by insects, mostly biting midges and mosquitoes. These diseases are animal viruses. The viruses are grown in the unit's cell culture facility for examination and are kept in collections for later reference.

Engineering and Wind Erosion Research Unit

The most diverse unit at the center has two primary research projects: sorting technology and wind erosion.

Sorting technologies are of great value to plant breeders and industry, Shanower said. The equipment can sort based on a number of characteristics, including protein content, seed color and the presence or absence of something, such as a fungal disease in plants.

Wind erosion research has been ongoing since the Dust Bowl. The importance of this research has increased with recent discussions by the Environmental Protection Agency on regulating the dust from agricultural lands. The unit currently has a military grant from Fort Riley to study wind erosion at military lands and how dust can be reduced in adjacent communities.

Grain Quality and Structure Research Unit

This unit develops new products and examines the biochemical structure of grain, specifically wheat and sorghum and the products from both.

One development has been with sorghum as a wheat substitute. Because sorghum lacks the gluten that allows bread to rise, it was developed as a better wheat substitute for those with celiac disease.

Hard Winter Wheat Genetics Unit

A specific cooperative agreement facilitates collaboration in this unit with K-State. Based in Throckmorton Hall, the group identifies genes with resistance or tolerance to heat and biotic-like rust or Hessian fly. The genes are then made available to plant breeders.

"We provide the genes, and they incorporate them into varieties that have better agronomic traits," Shanower said.

Stored Product Insect Research Unit

Controlling the effects of insects on stored products is the focus of this unit. The Food and Drug Administration sets specific tolerances for the amount of insect fragments that can be found in bulk commodities or finished products. Integrated pest management approaches are developed along with specific control measures.

Recently, the group collaborated with researchers at the Baylor College of Medicine to sequence the genome of the red flour beetle. This sequencing provides opportunities to target specific genes in the beetle as control mechanisms.

By Tyler Sharp, senior in history, mass communications and pre-law

K-State becoming major center for SWINE RESEARCH

Kansas State University is rapidly becoming a major center of vital swine research that also could play a role in human health.

Much of the multimillion-dollar research going on at K-State focuses on infectious and emerging swine diseases, some of which can be zoonotic — spreading from animals to humans and vice versa — like H1N1.

The College of Veterinary Medicine's Raymond "Bob" Rowland, and Dick Hesse, both virologists, and several other K-State researchers are involved with projects that could one day lead to better diagnostic tools and vaccines to control certain swine diseases.

> "I think what's really important about the research we do at K-State is the enthusiasm and talent of the people we get to work with, and the diversity of the teams we assemble to solve important animal health problems," Hesse said.

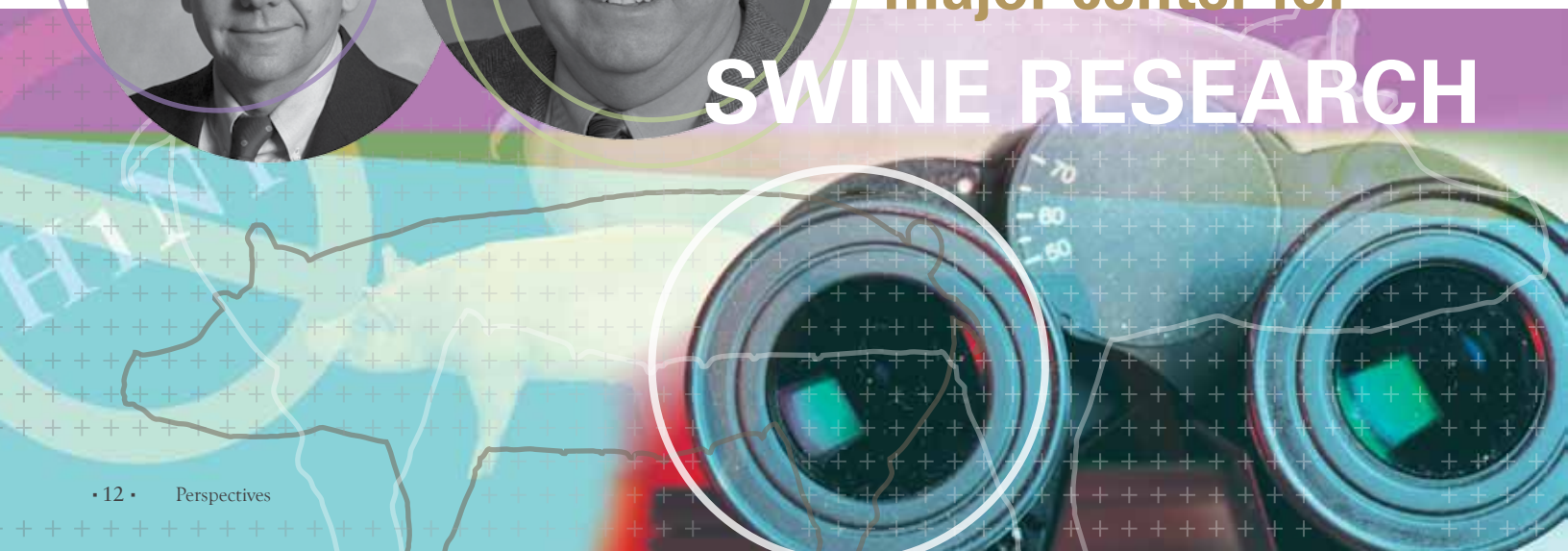
The projects Hesse and Rowland collaborate on or are involved with include:

- PRRS Host Genetics Consortium, a first-of-its-kind program for food animal genetics. PRRS stands for porcine reproductive and respiratory syndrome, which costs pig producers an estimated $700 million a year. The consortium includes K-State, Iowa State University, Michigan State University and Cornell; the U.S. Department of Agriculture's Agricultural Research Services; and private companies and commodity groups. The program looks at the genetics of infectious disease resistance and susceptibility. "Anyone who makes a contribution to the consortium has access to all the data and samples collected," Rowland said. To date the project has raised $3.7 million.
- The Porcine Reproductive and Respiratory Syndrome Coordinated Agricultural Project. Based at K-State, the $5-million, four-year project, supported by the USDA, is a comprehensive national program aimed at controlling the disease.
- Hesse's lab is working on genotypic characterization of bovine viral diarrhea viruses associated with bovine respiratory disease, as well as developing new sequence-based diagnostic and classification assays for bovine and porcine group A rotaviruses, which cause diarrhea in young animals. His lab also is working on a special vaccine development project on the newly emerging group C rotaviruses of nursery pigs.
- Work with several companies on emerging diseases. K-State researchers help isolate infectious agents, and then develop appropriate models that could help lead to the creation of vaccines.
- Porcine circovirus research and vaccine approaches. The work is being done by Hesse in K-State's Biosecurity Research Institute, a biosafety level 3 and biosafety level 3-agriculture research facility. The virus compromises a pig's immune system.
- Developing the next generation of diagnostic tools that are more predictive than reactive. The research includes working with companies to create diagnostics that go beyond telling if an animal is infected, to showing things like the status of the disease and the strength of vaccine protection.
- Collaborating with the Agricultural Research Service's Arthropod-Borne Animal Disease Unit in the Biosecurity Research Institute on projects related to animal diseases, primarily involving vaccines and diagnosis.
- A National Institutes of Health project involving the porcine reproductive and respiratory syndrome virus. "This virus can have interesting models for human infections," Rowland said.

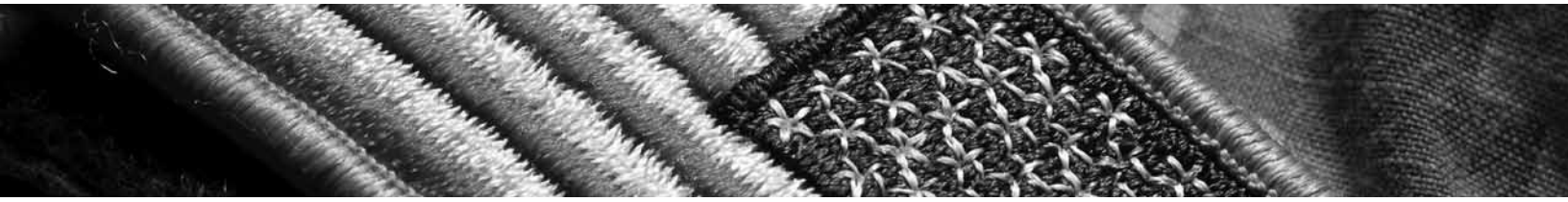
By Beth Bohn, Communications and Marketing

Bob Rowland

Richard A. Hesse



Dick Oberst



Detoxifying the dinner table

As deployed soldiers are aware, danger is a possibility on foreign soil. Thanks to a partnership with the U.S. Department of Defense, though, Kansas State University researchers are helping to ensure threats stay clear in one area: the dinner table.

In 2005 the U.S. Army Natick Soldier Research Development and Engineering Center partnered with K-State to study how to better protect American troops from the possibility of food-based threats.

"We're working to validate some rapid diagnostic protocols and equipment that will allow soldiers in the field to be able to assess whether or not their food rations are safe to eat," said Dick Oberst, professor of diagnostic medicine/pathobiology at K-State.

At K-State's Biosecurity Research Institute, or BRI, Oberst is leading the first study on certain bacteria classified as biosafety level 3, or BSL-3, and the first study using select agents.

Select agents are pathogens or biological toxins that have the potential to pose a severe threat to the public health and safety. In this case, the agents are listed as BSL-3, classifying them as serious or potentially lethal by the Centers for Disease Control and Prevention.

Many select agents could be found in foods from either intentional or unintentional contamination actions during the food production process or prior to consumption, Oberst said.

"That's why this information is especially important to the soldiers. A lot of the fresh produce and consumable food that they obtain in foreign countries is locally grown or processed," Oberst said.

"Because of this, our goal is to validate some of the fast test methods that the Army might use in order to see how effective they are when it comes to testing for various types of select agents in different foods," he said.

The first agents studied were toxins classified as biosafety level 2, or BSL-2, posing a moderate hazard to the researchers. Eventually the Natick Soldier Research Development and Engineering Center wanted to validate the test methods against more dangerous pathogens.

In the spring of 2010 K-State was approved by the Centers for Disease Control and Prevention and the United States Department of Agriculture to begin working with some select agents in the BRI.

Although research in BSL-3 biocontainment has been going on for only a few months, Oberst said working within the BRI's high-level containment labs will allow for an unprecedented level of investigation. He and other researchers will eventually be able to use technology and equipment in the BRI to go through the entire production process of foods in order to spot the exact point of contamination and to intervene with appropriate documentation methods.

Ultimately once this can be done, Oberst said it would allow food producers to not only know when a food is most susceptible to contamination in the production cycle, but would lead to information for developing diagnostic protocols and procedures to handle contamination of select agents.

"That's really what our long-term goal is," Oberst said, "to not only develop the best diagnostic approaches and countermeasures for the soldiers abroad, but also for civilian food safety."

By Greg Tammen, Communications and Marketing

LAYER by LAYER

A LOOK AT BRI SAFETY

Biosecurity Research Institute biosafety officer Julie Johnson likes to think of BRI safety as an onion: it has layers of precautions that keep the facility safe and secure. From lab construction and staff training to safety procedures, these layers of safety exist to protect staff, the public and the environment.

The BRI at Pat Roberts Hall is a biocontainment research facility that has enhanced biosafety level 3 (BSL-3) and biosafety level 3 agriculture (BSL-3Ag) labs. The labs are designed for work with pathogens — disease-causing microorganisms — that are transmitted by airborne means.

"There's often the misperception that pathogens are floating in the air in BSL-3 labs, and if you inhale you'll get sick," said Johnson, also K-State assistant vice president for research compliance. "It's not that way. We take many different precautions just in case multiple things go wrong."

The 31,000 square feet of lab, animal holding and support space allows scientists to research diseases such as wheat blast, highly pathogenic avian influenza, brucellosis, plague, tularemia or exotic bluetongue virus. Researching these types of pathogens is important for food safety and public health, Johnson said, but extra precautions are necessary to ensure safety.

The first basic layer of BRI safety starts with the construction of the building itself, which contains biocontainment and security features, Johnson said. Security includes a fence, secure entrances and security cameras.

Containment, the area inside the building where labs are located, is separated from the rest of the hallways and offices. Change rooms with interlocked doors mark the containment area entrance. Labs inside containment are isolated from each other and separated by an additional hallway that serves as a buffer zone in case any contamination occurs inside the labs. All labs are designed for maximum cleanability. Gas and liquid disinfectants are used for cleaning.

"An electronic building management system monitors air pressure differences between rooms and tweaks the ventilation systems to ensure constant proper airflow," Johnson said.

That means air moves from clean areas toward more potentially contaminated containment areas and never recirculates to other parts of the building. HEPA filters clean both the exhaust air and the supply air so it is clean for research.

The building's extensive back-up systems provide a precautionary layer of protection. A generator keeps critical systems running if power is lost. Duplicate exhaust fans and waste treatment tanks allow normal operation even during maintenance.

Well-trained staff who thoroughly understand biocontainment practices create another layer of safety, Johnson said. Staff members — including research, lab support and animal care staff — must take a 30-hour safety training course every year that includes hands-on practice in a simulated lab and participation in emergency drills.

After completing training, a layer of safety procedures protects staff when they work in containment.

Researchers must completely change out of street clothes and put on a fresh set of lab clothes before entering the containment area. When they reach their lab, they add another layer of protection: a lab coat, gloves and safety glasses. Depending on the activities they will conduct, they may also wear a respirator, shoe covers or even a second layer of clothing.

Researchers reverse this process when exiting the labs, shedding layers of protective equipment and leaving them in the more contaminated rooms they are exiting. They may also be required to shower before coming out of the containment area to protect any materials from entering the rest of the building.

All pathogen manipulations in labs are performed in biosafety cabinets, which are safety enclosures that use HEPA filters and directional airflow to contain pathogens in the cabinet.

"Learning to use biosafety cabinets is an important part of training," Johnson said. "People are taught to work slowly and methodically so they don't disrupt the air currents."

Pathogens are sealed in two layers of containers before transfer back to freezers to prevent any spills. All waste is autoclaved before leaving containment. An autoclave is a pressure cooker that kills pathogens using steam heat. Any liquid going down drains is treated in large cook tanks that also use steam heat.

"Nothing comes out of the labs that isn't disinfected in some way," Johnson said. "When we say nothing leaves containment without being decontaminated, that means nothing: air, liquid, waste, equipment and people."

The five BSL-3Ag rooms are for large animals that are loose-housed, so the room, instead of a biosafety cabinet, is the primary containment space. Such rooms have extra safety measures, including airtight doors, double HEPA-filtered exhaust and extra sealing of walls, floors and ceilings. Researchers must wear an extra level of protective gear and always shower before exiting these rooms.

Another layer of safety involves medical surveillance and emergency incident response plans. Scientists must have medical exams and receive necessary vaccinations before performing research. They're also taught to look for any medical symptoms related to pathogens they use in the BRI.

BRI staff communicates with Mercy Regional Health Center staff at least monthly to ensure hospital staff are aware of all pathogens being used in the BRI. The Mercy Occupational Health Services department develops specific surveillance, prevention and treatment plans. BRI staff also perform drills with local emergency response teams so everyone is prepared in the unlikely event of an accident.

All of these layers of protection help make the BRI a safe and secure location where scientists can conduct much needed research on pathogens. The research helps develop protective vaccines, diagnostic tests and treatments to prevent future outbreaks, protecting agriculture and public health.

By Jennifer Torline, Communications and Marketing

Safety of public is in expert hands

Standing against the autumn wind on a plot of land adjacent to K-State's Biosecurity Research Institute, three identical purple signs announce: "Future Home of NBAF."

The signs, situated along Denison and Kimball Avenues, face different compass directions, ensuring that passersby can hardly miss the clearing taking place for the National Bio and Agro-defense Facility, which is no small subject.

"It will be a certainty that when completed, NBAF will incorporate the latest state-of-the-art design and advanced technologies, making it the most modern and safe agricultural biocontainment facility in the world," said K-State's Jerry Jaax, a veterinarian and associate vice president for research compliance.

NBAF in Manhattan will be an extensive biocontainment laboratory, where researchers will study diseases that threaten animal agriculture and public health. The facility is being constructed through a partnership with the U.S. Department of Homeland Security and the U.S. Department of Agriculture.

According to the DHS website, the facility will be 500,000 gross square feet with 10 percent of its space dedicated to BSL-4 research, a biosafety classification that the American Biological Safety Association cites as designated for dangerous and exotic agents.

Jaax said the DHS would employ extensive safety and security measures to protect the K-State and Manhattan communities.

An estimated 300 to 350 personnel will be working in NBAF, according to Jaax, and all personnel will be required to have background and security checks as well as formal safety and technical training.

To keep NBAF running smoothly, the facility will require the expertise of a wide range of skilled workers, including logisticians, engineers, technical writers, motor pool specialists, custodial and administrative staff, security officers, and of course, safety, biosafety and occupational health professionals.

The Manhattan facility will benefit from advancements in biocontainment research and development over the last several decades.

"Biocontainment construction and operational technology has rapidly progressed over the last 60 years," Jaax said. "NBAF will incorporate successful technologies and designs used in dozens of other biocontainment laboratories around the world."

Construction of the facility's central utility plant and laboratory is projected to begin in FY2011. For more details, visit the DHS website at www.dhs.gov.

By Kimetris N. Baltrip, assistant professor, A.Q. Miller School of Journalism and Mass Communications

Randall K. Phebus

At K-State research focuses on food safety, health for all

Oh no, not more news about E. coli …

Most people are aware of the efforts to reduce health risks from E. coli O157:H7 linked to undercooked ground beef and fresh produce, including spinach and lettuce.

While the focus on minimizing the risks of O157:H7 is ever present, recent concerns about an emerging, cousin-like group of microorganisms — dubbed non-O157 STECS (short for Shiga Toxin Producing E. coli) — is the focus of comprehensive research at Kansas State University.

The name has changed slightly, but this broader group of E. coli strains can produce the same toxins and same threat of potentially life-changing illnesses (kidney failure is an example), said Randy Phebus, K-State Research and Extension professor of food safety and defense, who offered a sobering example of an active, healthy 25-year-old female confined to a wheelchair and requiring dialysis following illness due to the foodborne pathogen.

Food should nourish, not harm, said the food safety professor, who noted that K-State is internationally recognized as a center for food animal health and meat safety, and is now being looked to as a leader in new — and increasingly sophisticated — food safety research.

According to Phebus, the addition of the Biosecurity Research Institute, BRI, at K-State positions the university to fulfill a leadership role in identifying potential food contamination and developing successful interventions to curb growing concerns about STECS and other potentially life-threatening microorganisms.

The BRI is uniquely set up to allow scientists to replicate commercial systems for livestock processing, identify risk factors for specific pathogens and develop appropriate antimicrobial interventions and detection methods, said Phebus, who explained that the research begins as an animal enters the facility and continues until beef trimmings are ground into hamburger like that which enters the market.

The new research facility is the only one of its kind, where farm to plate food safety can be replicated under one roof, said Phebus, who said that suiting up in protective gear to enter the facility takes about 30 minutes.

"It's similar to preparing for a moon walk, but keeping researchers safe is the first step in food protection," he said.

While Phebus has focused on food safety during his 19 years at K-State, the addition of "defense" to his job title speaks to the expanding focus: "Food safety specialists remain concerned about foodborne contaminants and naturally occurring microorganisms, but now must be increasingly watchful in detecting manmade contaminants and the possibility for intentional acts of bioterrorism or sabotage that could jeopardize the nation's — and world's — food supply, health and economic stability."

Much of his current research is underwritten by funding from U.S. Department of Defense grants evaluating the safety of military food supplies, but Phebus said the research also strongly supports a greater understanding of general food safety for all consumers.

To make it happen, Phebus and others at K-State, including researchers with the university's Food Science Institute in the College of Agriculture and the Beef Cattle Institute in the College of Veterinary Medicine, are engaged in the research.

While the research is expected to benefit livestock production at all levels, Phebus said he and others at the university also are actively engaged in additional research and educational collaborations with other universities, governmental agencies and national laboratories.

"Research has to be ongoing," said Phebus, who is optimistic about ensuring a safe food supply for all.

Phebus is a highly respected food safety scientist and has been selected to chair the International Association for Food Protection's centennial conference program committee in 2011.

By Nancy Peterson,
K-State Research and Extension News Media Services

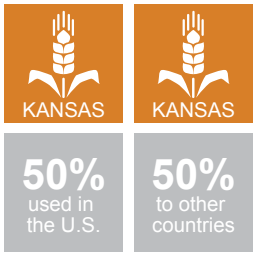
K-State, USDA Scientists Working to Protect Wheat Crop from Deadly Disease

Wheat Blast Research Conducted in University's Biosecurity Research Institute

Barbara S. Valent

Kansas Wheat by the Numbers

Kansas typically grows nearly one-fifth of all wheat grown in the U.S.

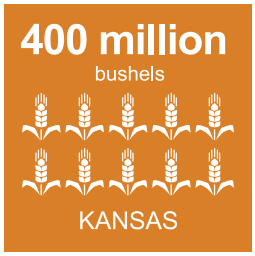


Half of Kansas-grown wheat is used in the U.S.; the other half is exported to other countries.

About 8.8 million acres of wheat are planted in Kansas.

Kansas ranks first in the nation in flour milling, wheat gluten production and wheat stored.

Roughly one-third of Kansas's 63,000 farmers grow wheat.



Kansas farmers typically produce about 400 million bushels of wheat a year.

Kansas State University researcher Barbara Valent is in preventive strike mode.

Valent, a university distinguished professor of plant pathology, is leading a team of K-State and government scientists who are working to find ways to protect Kansas and U.S. wheat fields from the deadly disease known as wheat blast.

"This disease spreads quickly. It has not been found outside South America, but if we don't prepare by learning and educating others about detection, and look for ways to curb it if it does strike the U.S., the consequences could be enormous," she said.

First discovered in Brazil in 1985, the fungus has since been found in Bolivia, Paraguay and Argentina. Valent said 2009 was a particularly bad year, with the disease cutting production in Brazilian wheat states by 25 to 60 percent.

"Our goal is to identify resistant varieties," she said. "We're also developing tools for rapid detection and accurate diagnosis of the pathogen, and we're establishing training resources and a web-based network to facilitate diagnosis and distribution of resistance resources."

Because the disease has not been found in North American wheat, it is crucial that the team's research be conducted in a secure facility. For that reason the researchers are working in K-State's Biosecurity Research Institute, a facility that provides scientists with a safe and secure location to study high-consequence pathogens.

"Part of our goal is also to train students to work in this environment. Work with emerging diseases in biocontainment labs is an important part of this project," she said.

Other principal investigators on the team include K-State plant pathology professors Bill Bockus and Jim Stack and U.S. Department of Agriculture-Agricultural Research Service scientists Gary Peterson and Kerry Pedley. Pedley and Peterson are based at Fort Detrick, Md.

The project is funded by a $999,688 grant from the USDA's National Institute of Food and Agriculture.

At stake, in Kansas alone, is a crop that over the last several years has been valued at $1.3 billion to $1.7 billion a year, according to K-State agricultural economist Dan O'Brien.

"It is not clear if wheat blast would survive in the Kansas climate," said Valent, who along with USDA's Peterson, traveled to Brazil in May 2010 to give a presentation at an international conference focused on the disease. They were the only two representatives from the U.S. at the conference.

So far the research team has studied 72 varieties of wheat that are grown in Kansas to determine how they respond once infected with wheat blast. In that way, they can determine which are the most resistant and which are the most vulnerable.

"Because the symptoms of wheat blast closely resemble those of a common disease in U.S. wheat called head scab, it is imperative for producers to be able to tell the difference," Valent said.

The researchers are working together with scientists in K-State's Integrated Genomics Facility to obtain the fungus's genome sequence, which is important for identifying the genes involved in wheat infection.

Because outreach and education are important components of the project, the research team has met with representatives of the Kansas Wheat Commission, Kansas Department of Agriculture, USDA's Animal and Plant Health Inspection Service, and other K-State faculty. More workshops, webinars, extension fact sheets and other educational efforts are planned.

By Mary Lou Peter, K-State Research and Extension

Private Sector Opportunities Abound with the Arrival of NBAF

As preparatory work and preliminary construction progresses on the National Bio and Agro-defense Facility site north of Kansas State University, the opportunities for the private sector continue to grow.

The arrival of the $650 million Department of Homeland Security facility will foster local and regional development, university leaders say, and may create new partnerships for K-State, the Manhattan community and animal health companies both inside and outside the Kansas City Animal Health Corridor.

"Only time will tell how many and what kind of private sector opportunities will arise because of NBAF," said Ron Trewyn, K-State's vice president for research. "But I think it's pretty clear with all the Animal Health Corridor companies that are in the area that there is great potential."

When the Department of Homeland Security named Manhattan as the official site for NBAF in early 2009, Trewyn was amazed at the number of pharmaceutical companies that started contacting K-State, the Manhattan Chamber of Commerce and the Kansas Department of Commerce. While some of the larger companies were interested in expanding to the Manhattan area, other smaller animal health companies talked about completely relocating to the area.

Companies of all sizes were interested in opportunities both at K-State and in the Animal Health Corridor region, which stretches from Manhattan, Kan., to Columbia, Mo. This region is already a hotspot for animal health — containing one-third of the world's marketplace for animal health companies and including more than 13,000 employees — but the addition of NBAF makes it even more appealing.

The Pre-Decisional Draft of NBAF

"Some of the companies in this region are expressing interest in what might be available near the NBAF site in Manhattan," Trewyn said. "But we're also being contacted by animal health companies that aren't currently located in the Animal Health Corridor."

With construction of the lab itself slated to begin in early 2012, it's likely that more companies will be attracted to the area. While there is limited land close to campus for companies to build, Trewyn noted that space is available throughout the Manhattan area. He pointed to the 25-acre K-State Research Park on Manhattan Avenue east of the NBAF site as a potential place for companies to locate.

While negotiations with companies are still in the early stages, the arrival of NBAF will also give K-State the ability to compete for science or policy-related programs, particularly related to zoonotic and animal diseases. NBAF's emphasis on animal vaccinations, as well as new antibiotic and antiviral treatments, will help attract animal health companies that focus on infectious diseases or diagnoses.

"When it comes right down to it, Manhattan is going to become the epicenter for the world's animal health," said Daniel Thomson, who is the Jones professor of production medicine and epidemiology for the K-State College of Veterinary Medicine. His research group has used K-State facilities to develop the E. coli O157: H7 vaccine for cattle.

Thomson sees huge potential for animal health private industry because NBAF and K-State's Biosecurity Research Institute will provide new biosafety level 3 and level 4 laboratories, where scientists can research pathogens such as foot-and-mouth disease, swine fever and anthrax.

"I think it will attract some of the best and brightest minds to work in these facilities," Thomson said. "The collaboration that K-State will be able to do with those facilities will help K-State recruit the best and brightest students as well."

The development of animal vaccines will be particularly important, Thomson said. When researchers are able to develop vaccines, they'll need industry partners to produce the vaccines. In many cases, it makes sense for animal health and pharmaceutical companies to be geographically close to the researchers.

"When I look at NBAF and K-State as a whole, the way I describe Manhattan is the front gate to the west," Thomson said. "Our function at Kansas State University is to be the gate — that ability to scientifically and independently review the things that are coming from the industry to improve the health and performance of animals.

"We're at the point in time where industry and agriculture shake hands," Thomson said.

By Jennifer Torline, Communications and Marketing

About the Biosecurity Research Institute

Biocontainment facilities are classified by the Centers for Disease and Prevention Control and the National Institutes of Health into four distinct levels, depending on the nature of the research and the biological agents that will be used in the laboratory. These levels are Biosafety Level 1, 2, 3 or 4, and are normally designated as BSL-1, BSL-2, BSL-3 and BSL-4.

Biosafety level 1 basically covers organisms that are not normally hazardous to healthy adults. Biosafety level 2 covers organisms and biological materials that pose moderate hazards to adults and personnel. These laboratories also have limited access and documented procedures for handling biological materials. Biosafety level 3 designates work with biological materials that could cause serious illness — including death — to humans if not handled properly. Biological materials falling into this category include pathogens like the West Nile virus. The highest level of biosafety is BSL-4, which involves work with biological materials where vaccines are not currently available and which require workers to wear full hazmat-like positive pressure suits with self-contained air supplies.

The Biosecurity Research Institute will not be working with any BSL-4 biological materials. The BRI is a BSL-3 and BSL-3Ag facility, the latter an enhanced and specialized form of BSL-3 for working with livestock. BSL-3Ag incorporates almost all the same construction features of a BSL-4 facility and must meet specific construction standards set by USDA for the rooms to be primary containment barriers. However, the self-contained "space suits" are not required.

At K-State all laboratories are inspected by the Environmental Health and Safety office. Those using biological materials must have their activities approved by the Institutional Biosafety Committee. These approvals follow a prescribed process and include site inspections by the Institutional Biosafety Committee and University Research Compliance Office for facility compliance, as well as for appropriate documentation for laboratory policies and procedures.

In order to work with more hazardous biological materials, additional external inspections must be made by organizations such as the CDC or the U.S. Department of Agriculture. This is the case with the most rigorously regulated biological materials, which are termed "select agents." Facility inspections are done for each specific project involving a select agent to ensure that the facility is configured appropriately, that the support staff are trained to safely handle the specific select agent, that the experimental plans and security measures for the select agents are appropriate and documented, and that the select agent can be used in a safe and secure manner for the facility personnel and surrounding community.

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Jan Sargeant, *DVM, M.S., Ph.D*

Alfonso Torres, *DVM, M.S., Ph.D.*

Dr. Guy Palmer is the Creighton chair and director of the Washington State University School for Global Animal Health and the Regents professor of pathology and infectious diseases. Dr. Palmer's goal is to improve the control of animal diseases with direct impact on human health and well-being. Within this focus, he has led collaborative infectious diseases research programs in southern and eastern Africa, the Middle East, and Latin America, where he currently directs a multi-institutional research effort studying genetic change in microbial pathogens and the risk for shifts in disease pattern and emergence.

> "The Biosecurity Research Institute provides a unique resource needed to discover and fully develop innovative approaches to control infectious diseases. While clearly providing new opportunities for K-State faculty and affiliated scientists, the BRI is also a regional and national resource that can catalyze research to improve both livestock productivity and public health."

Dr. Jan Sargeant is the director of the Centre for Public Health and Zoonoses at the University of Guelph in Ontario, Canada. Dr. Sargeant has performed research in areas of agri-food public health, policy research in microbial food safety, perception of risk of gastrointestinal illnesses, food and water safety, and the role of veterinary medicine in public health. She is currently developing a research agenda focused on policy and outcome evaluation issues in the prevention of zoonotic disease.

> "The Biosecurity Research Institute at Kansas State University is unique in its ability to support high containment infectious disease research activities from basic discovery research through live animal and plant experiments. The diversity of approaches also leads to scientists from multiple disciplines working together and networking. This dynamic research environment and innovative research facility will produce research results that will lead to improved human and animal health in the U.S. and internationally."

Dr. Alfonso Torres is the associate dean for public policy in the College of Veterinary Medicine at Cornell University. Prior to his current position, Dr. Torres served as the deputy administrator for Veterinary Services of USDA APHIS and U.S. chief veterinary officer and delegate to the World Organization for Animal Health. Dr. Torres was the director of the USDA's Plum Island Animal Disease Center on Plum Island, N.Y., from 1996 to 1999, following three years as chief of the Foreign Animal Disease Diagnostic Laboratory there. Prior to his service at USDA, Dr. Torres held academic positions at the National University of Colombia, the University of Nebraska-Lincoln, and Cornell University. Between academic experiences, Dr. Torres also worked in research and development and marketing of veterinary biologics and diagnostics with two large multinational corporations.

> "The Biosecurity Research Institute's current capability provides a significant jumpstart for Kansas State University to work in this important field ahead of the construction and activation of the National Bio and Agro-defense Facility, placing K-State as the leading U.S. academic institution in the field of research on the most important pathogens that affect the health of plants, animals and people."