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KANSAS STATE UNIVERSITY | Office of Governmental Relations

K-State Biodefense: On the front line of COVID-19 and beyond

In our June newsletter, we shared highlights of some of the contributions our scientists and educators are making to the fight against COVID-19. However, K-State's legacy of protecting food, agriculture and communities from disease outbreaks began long before this pandemic.

Ernie Minton, dean of the K-State College of Agriculture, referenced this legacy in his June 2020 statewide address.

"We're living in a time when our land-grant mission to teach, explore and broadly share what we learn has never been more important. Rarely, has our state or nation been confronted with a challenge that requires the best from all of us – our scientists; economists; livestock, crop, food safety and family health experts; teachers and community leaders. During this pandemic, they are working tirelessly and together finding and sharing solutions to address the needs of ag producers, businesses, industries, communities and families across the state and nation in ways that sustain us through this situation and help us come back even stronger when it ends."

This month's edition provides an overview of some of the assets and capabilities that arm us for the battles.

The Silicon Valley of Biodefense: Protecting food, agriculture and communities from disease outbreaks

Kansas State University has a long history in fighting against diseases such as COVID-19. It began with the production of antisera for classical swine fever in 1908 and has accelerated since. K-State's role in protecting agriculture, food and communities from disease outbreaks became nationally prominent in 1999 with the publication of "Homeland Defense Food Safety, Security, and Emergency Preparedness Program." The 100-page document — informally called "The Big Purple Book" — outlined the university's research programs in three major infectious disease components: plant pathology, animal health and food processing. The document described research and teaching efforts of more than 130 K-State faculty working on endemic threats to food crops, food animals and the food supply. It also outlined research needs in the field of food safety and preparation. This foundational plan, and the capabilities that it described, led to the construction of the Biosecurity Research Institute at Pat Roberts Hall on the K-State campus and helped attract the National Bio and Agro-defense Facility (NBAF), a $1.25 billion federal lab with 400 employees when fully operational, to Manhattan.

Today, K-State is home to numerous facilities, research collaborations and academic programs devoted to bio and agro-defense. Here are just a few:

- The Biosecurity Research Institute (BRI) at Pat Roberts Hall is a one-of-a-kind facility that accommodates research and training on infectious disease threats to plants, animals and humans. The BRI was the first non-federal lab in the nation approved to conduct studies on certain high-consequence livestock-related pathogens such as African and classical swine fevers. K-State scientists at the BRI are working on COVID-

related projects and are jump-starting research on NBAF diseases. The BRI was cited as being instrumental to the federal government's choice to locate NBAF in Manhattan.
- The College of Veterinary Medicine has research strengths in animal health infectious diseases, comparative biomedical science and food safety and security.
- The Veterinary Diagnostic Lab is processing COVID-19 diagnostic tests in the BRI for humans and animals.
- The College of Agriculture conducts research in agricultural and horticultural crops, livestock, natural resources and the environment.
- The National Agricultural Biosecurity Center, or NABC, unites biosecurity researchers with federal, state and local agencies to provide a response to emerging agricultural threats.
- The U.S. Department of Homeland Security's Center of Excellence for Emerging and Zoonotic Animal Diseases, or CEEZAD, develops countermeasures for emerging high-priority animal diseases that can spread to humans. It's based in the College of Veterinary Medicine.
- The Food Animal Residue Avoidance Databank, or FARAD, hosted by the College of Veterinary Medicine, is a risk-management program that provides science-based expertise to help mitigate unsafe chemical residues, such as from drugs, pesticides and biotoxins, that might be found in products derived from food animals.
- The K-State Plant Disease Diagnostic Lab, leader of the Great Plains Diagnostic Network, provides information on disease identification and management, and processes more than 1,000 samples from Kansas each year. The samples help K-State keep a pulse on what plant diseases are active around the state. The network is led by a globally renowned K-State scientist.

These assets and experts have combined to earn K-State the reputation of the "Silicon Valley for biodefense", a moniker coined by a former U.S. Senate majority leader and member of the prominent Bipartisan Commission on Biodefense.

Training next generation to fight diseases

Sizzling bacon, smoky pulled pork, mouthwatering barbecue ribs and even the holiday ham could disappear from meals if African swine fever virus ever made its way to the U.S. While the disease does not affect human health, it is nearly 100% fatal to pigs in less than two weeks and could cause billions of dollars in economic damages for U.S. producers.

Within 12 years of the virus emerging in the country of Georgia, African swine fever has spread throughout most of Eastern Europe and across the entire continent of Asia. African swine fever virus and classical swine fever virus, another concerning disease, have not shown up in any U.S. swine populations yet. To keep it that way, Kansas State University is training the next generation of biosecurity and biosafety scientists while also conducting research to combat the most threatening agents to the world's food supply, including swine fever viruses and many other pathogens.

The K-State Biosecurity Research Institute at Pat Roberts Hall, or BRI, houses several multidisciplinary research programs on pathogens that affect animals, plants and insects as well as food safety and security. No other facility can do all that the BRI can do in one spot when it comes to plants, animals and insect work.

The BRI is the first non-federal laboratory to be approved to research the African and classical swine fever viruses. In addition to these viruses, the BRI also has research projects that are fighting COVID-19, wheat blast, a fungal disease that devastates wheat harvests; Japanese encephalitis virus, a mosquito-borne pig disease that can be transmitted to humans; Rift Valley fever virus, a mosquito-borne virus that infects cattle, sheep and goats as well as humans; highly pathogenic avian influenza, which has been detected in more than 50 countries in Africa, Asia, Europe and the Middle East; and foodborne pathogens such as Shiga toxin producing *E. coli.* K-State scientists are working to understand these diseases, identify what plant and animal strains are resistant and develop rapid diagnostic tests, vaccines and treatments so if something hits this country, we can identify it and respond before it is widespread.

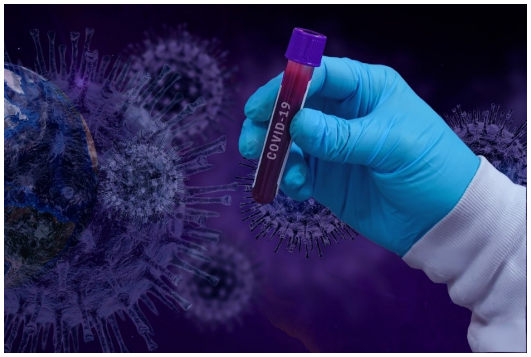
Next-generation preparation

As a land-grant university, K-State is using the research to train students and improve current practices. In the simulated BSL-3 training lab, which is one of only a few in the nation, students and researchers learn how to properly handle, decontaminate and dispose of high-consequence agents; how to safely enter and exit a containment lab; how to work in a BSL-3Ag lab; and what to do in an emergency while in the lab.

Working with economically devastating pathogens requires not only extensive education but the utmost safety and security, which is integrated throughout the BRI. The protocols in the BRI's BSL-3 and BSL-3Ag labs give students hands-on experience, help them build their resumes and prepare them for careers in fighting diseases and securing the nation's food supply.

"The training I received here has been invaluable to my work," Daniel Madden, a graduate student in the College of Veterinary Medicine said. "K-State possesses the infrastructure to conduct research on high-consequence and emerging pathogens. The BRI is one of the few facilities capable of handling research

on dangerous livestock diseases in a high-containment setting. The breadth and depth of experience I have gained here is simply not available at other universities."



Veterinary Research team receives $11.3 million grant to establish infectious disease research center

The National Institutes of Health is awarding a Kansas State University-led team of veterinary researchers with a prestigious five-year, $11.3 million grant under the Centers of Biomedical Research Excellence, or COBRE, program to establish a new Center on Emerging and Zoonotic Infectious Diseases, or CEZID.

The center will comprise four primary research projects that will bridge areas of excellence in the collective infectious diseases programs at Kansas State University involving the colleges of Veterinary Medicine and Arts and Sciences.

"Our projects will examine virulence factors and host-pathogen interactions of various pathogens, utilizing both basic and translational approaches in in vitro systems and in models," said Jürgen Richt, Regents distinguished professor at Kansas State University and a Kansas Bioscience Authority eminent scholar in the College of Veterinary Medicine. Richt will serve as director of the center. Philip Hardwidge, professor of diagnostic medicine and pathobiology in the College of Veterinary Medicine, will serve as associate director.

"The overarching goal of the CEZID is to advance our overall understanding of emerging and zoonotic infectious diseases based on research performed in the state of Kansas," Richt said. "Our goals are also clearly aligned with NIH's strategic plan "Turning Discovery into Health.'"

"The truly unique and competitive advantage of the CEZID program is that it brings a multipronged and multidisciplinary approach to understanding and attacking zoonotic infectious diseases," said Peter Dorhout, vice president for research at K-State. "Our ability to better understand how these diseases behave, which include the family of coronaviruses that comprises our current global pandemic, will enable our researchers to create rapid responses to future calamitous outbreaks that affect both human and animal health. These teams will deliver science-based solutions to improve people's lives."

The success and growth of CEZID will be enabled through various programs such as a pilot grant program that will promote center growth by funding smaller projects at universities in the state of Kansas,

National Bio and Agro-defense Facility (NBAF) Update

The National Bio and Agro-defense Facility, or NBAF, will be America's foremost animal disease research facility. It's being constructed by the U.S. Department of Homeland Security.

The $1.25 billion facility is a biosafety level-4 laboratory and will replace the aging Plum Island Animal Disease Center in New York. NBAF is expected to be operational by 2022-2023.

The 46.828-acre NBAF site is on the north end of the KSU main campus. When the Manhattan site was selected in 2009 after a 3-year national competition, there were animal facilities on the site that had to be removed prior to NBAF site preparation as can be seen below. KSU's biocontainment facility, the Biosecurity Research Institute (BRI) at Pat Roberts Hall, is adjacent to the NBAF site. Notably, in 1908, the KSU College of Veterinary Medicine began producing antisera for hog cholera (a.k.a. classical swine fever; CSF). CSF is one of the foreign animal diseases projected to be worked on in NBAF. KSU research on CSF was reinitiated in the BRI in 2015. Three other NBAF diseases are also being worked on in the BRI; Rift Valley fever beginning in 2013, Japanese encephalitis in 2014, and African swine fever in 2016.

The SARS-CoV-2 (COVID 19) pandemic has corroborated the need for state-of-the-art facilities like NBAF to be better prepared for infectious disease outbreaks of all types. Because most pandemic threats today are zoonotic diseases that can be transmitted from animals to people, more effort must be focused on mitigating these threats in the host species before they impact public health. NBAF should help address this deficiency.

For a current update on progress, you can listen to a recent WIBW Radio podcast with USDA NBAF Coordinator Dr. Ken Burton HERE.

Plant pathologist Barbara Valent named to National Academy of Sciences

A Kansas State University plant pathologist Barbara Valent has earned membership in the prestigious National Academy of Sciences (NAS), becoming the

and a regional scientific network that will provide interdisciplinary and interinstitutional collaborations.

Hardwidge said the Center on Emerging and Zoonotic Infectious Diseases has the potential to provide a vital service to the nation in the area of infectious disease research.

"In this era, interest in the control of the spread of infectious diseases is obviously of substantial importance both within the scientific community and in the general population, Hardwidge said. "We believe this center can greatly expand our general ability to respond effectively to future outbreaks."

DID YOU KNOW?

For more than 100 years, K-State scientists have worked to mitigate biological threats to food sources and human health. An early example is Kansas State University's production of a treatment for classical swine fever in 1908.

first scientist at K-State to earn the honor for original research conducted while at the university.

While Valent has been in the center of international work, her team has also helped to keep the fungus from infecting U.S. wheat fields. Working in K-State's Biosecurity Research Institute, a biosafety level-3 and biosafety level-3 agriculture facility, the researchers were the first to discover a resistance gene called 2NS for wheat blast disease.

"Professor Valent has made, and continues to make, significant and leading contributions to understanding virulent plant diseases that impact global food production and access," said Peter Dorhout, K-State vice president for research. "Her research enables the world to provide greater levels of food surety and food security to its people."

Valent has worked on understanding blast disease, caused by a fungus known to scientists as Magnaporthe oryzae, for more than 40 years. In the last decade, her work has focused on wheat blast, a dangerous new disease in which the fungus is capable of taking out entire wheat fields.She has led a research team that is driving the world's most comprehensive studies on wheat blast to keep it out of the United States.

The NAS is considered the country's leading authority on matters related to science and technology.

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