The future of biocontainment research at Kansas State University

Bonnie R. Rush, DVM, MS, DACVIM; Stephen Higgs, PhD, FRES, FASTMH; Dana L. Vanlandingham, PhD, MS, FRES; Juergen A. Richt, DVM, PhD

1College of Veterinary Medicine, Kansas State University, Manhattan, KS
2Biosecurity Research Institute, Kansas State University, Manhattan, KS

*Corresponding author: Dr. Rush (brush@vet.ksu.edu)

When Drs. Nancy and Jerry Jaax graduated from Kansas State University in the 1970s, they were unaware that their study of emerging diseases would become the subject of the best-selling 1994 novel The Hot Zone by Richard Preston. Today their legacy lives on, with K-State well positioned to become a preeminent institution to advance discovery for transboundary, emerging, and zoonotic diseases. With K-State’s Biosecurity Research Institute (BRI), Centers of Excellence, and USDA National Bio and Agro-Defense Facility (NBAF), K-State is the only US university with biosafety level-1 (BSL-1) through BSL-3 facilities adjacent to a federal facility capable of housing livestock at the highest level of containment, BSL-4.

K-State’s NIH-funded Center on Emerging and Zoonotic Infectious Diseases supports early-career faculty to develop novel therapies and vaccines against zoonotic and emerging pathogens and trains a proficient workforce for BSL-2, BSL-3, and BSL-4 facilities. Primary research themes include virulence factors and host-pathogen interactions for high-consequence pathogens by use of in vitro systems and animal models. The DHS-funded Center of Excellence for Emerging and Zoonotic Animal Diseases was established in 2010 to help protect the nation’s agricultural resources against high-consequence foreign, emerging, and zoonotic diseases. Principal missions include development of novel vaccines, point-of-need pathogen detection, models to predict disease behavior, and workforce development programs for high-impact animal diseases.

K-State’s BRI supports multidisciplinary research with select biologic agents that threaten human and animal health in a BSL-3 and BSL-3Ag biocontainment environment. K-State scientists investigate animal models and mitigation strategies for SARS-CoV-2, Rift Valley fever, African swine fever, and Japanese encephalitis, among other pathogens. The Biologic Development Module (BDM) within the BRI allows corporate partners to develop diagnostic, therapeutics, and preventive countermeasures in high containment for a broad range of select agents from proof of concept to scalable production. The BRI-BDM provides BSL-2 containment space to rapidly manufacture products to protect livestock and the food supply during an emerging disease outbreak. K-State’s National Agricultural Biosecurity Center unites high-containment researchers with federal, state, and local agencies to provide coordinated responses to emerging agricultural threats.

The USDA’s NBAF will replace the Plum Island Animal Disease Center in New York and has an expanded research mission and select agent profile. The state-of-the-art facility is the first US facility with BSL-4 containment capable of housing livestock on US soil. The USDA’s Agricultural Research Service and Animal and Plant Health Inspection Service will conduct foreign, emerging, and zoonotic animal disease research, training, and diagnostics in the facility. The NBAF will contain a BDM with contemporary pilot plant equipment for progression to large-scale manufacturing of innovative countermeasures for high-consequence infectious diseases.

K-State faculty members are committed to training the next generation of scientists to conduct research on high-consequence pathogens. Using the dedicated training laboratory at BRI, students at the technician, master’s, and doctoral levels train to work in high containment using BSL-3 practices in a low-stakes environment. K-State plays a leading role in training scientists, staff, and facility operators that will ultimately work at the USDA’s NBAF.

K-State will have unparalleled capacity for innovative research on emerging biological threats to agriculture and people through this expertise and infrastructure.