

Expression of University Strengths

February 2020



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TABLE OF CONTENTS

MEMORANDUM FROM PRESIDENT RICHARD B. MYERS

AGRICULTURE

- 1.1 College of Agriculture Research, Teaching, and Extension Facilities
- 1.2 Agriculture Advanced Research and Development (AgARDA)
- 1.3 National Plant Diagnostic Network
- 1.4 National Animal Health Laboratory Network (NAHLN)
- 1.5 The Wheat Genetics Resource Center Industry/University Cooperative Research Center (WGRC IUCRC)
- 1.6 Addressing the Antimicrobial Resistance Challenge
- 1.7 Rural Economic Development Through Youth Entrepreneurship
- 1.8 Food Animal Residue Avoidance and Depletion (FARAD) Program
- 1.9 Rural Stress and Mental Health
- 1.10 The Center for Food Safety in Child Nutrition Programs
- 1.11 Center for Sensory Analysis and Consumer Behavior
- 1.12 Pre-Harvest Food Safety and Security
- 1.13 Healthy Food Systems for Healthy People
- 1.14 Conserving the Ogallala Aquifer
- 1.15 Urban Food Systems Institute
- 1.16 Transboundary and Emerging Infectious Diseases of Food Animals
- 1.17 Preparing the Bio/Agrodefense Workforce
- 1.18 Global Food Systems Initiative
- 1.19 Population Health: Center for Outcomes Research and Epidemiology (CORE)
- 1.20 Integrated Solutions for U.S. Bio/Agrodefense: National Agricultural Biosecurity Center
- 1.21 Research & Development for U.S. Bio/Agrodefense: Protecting Agriculture and Preserving Public Health
- 1.22 College of Veterinary Medicine/Association of American Veterinary Medical Colleges
- 1.23 EPICENTER: Laboratory for a Network Science Approach to Predict and Control the Spread of Infectious Diseases; within the Network Science and Engineering (NetSE) Group

COMMERCE, JUSTICE, SCIENCE

- 2.1 Konza Prairie Biological Station: A World-Class Platform for Research on Ecology, Environmental Change, and Sustainability of Rangeland Resources
- 2.2 Bulk Solids Innovation Center

- 2.3 Cultural Digital Transformation
- 2.4 Science Communication Initiative
- 2.5 GEOSMART: Space as the Framework for Advancing Discovery and Developing the 21st Century Workforce
- 2.6 Robustness of Networked Infrastructures with Application to the Beef Cattle Industry
- 2.7 Community Collaboration in Juvenile Justice
- 2.8 Microbiomes of Aquatic, Plant and Soil Systems (MAPS): Mediating Sustainability
- 2.9 Engineering Research Center for ENgineered Solutions for rUral REsilience — ENSURE: Food, Energy, Environment, and Infrastructure
- 2.10 Microfluidic Organs-on-a-Chip: Bioprinting, Culture and Diagnosis of 3D/4D Biomimetic Tissues In Vitro
- 2.11 Building Transformational Innovation-based Partnerships
- 2.12 Supporting Accountability and Program Improvement Through Evaluation
- 2.13 Diversity and Inclusion in Educational Settings
- 2.14 Furthering Ethical and Responsible Research
- 2.15 CNH: Coupled Climate, Cultivation, and Culture in the Great Plains: Understanding Water Supply and Water Quality in a Fragile Landscape

DEFENSE

- 3.1 Nuclear Radiation Detector and Systems Development
- 3.2 Military Connected Learners: Research and Teaching
- 3.3 Improving Mental Health and Well-being by Building Healthy Relationships and Ending Violence
- 3.4 Immersive 3D/4D Visualization for Education and Research
- 3.5 Supporting Accountability and Program Improvement Through Evaluation

ENERGY AND WATER

- 4.1 J.R. Macdonald Laboratory: Atomic, Molecular, and Optical Physics Research Using Ultrafast Lasers
- 4.2 Affordable and Suitable Housing
- 4.3 Additive and Laser-Based Manufacturing for Energy, Aerospace, Micro/nano Electronics and Biomedical Applications
- 4.4 Innovation in High Performance Building Envelopes Collaborative Research Program
- 4.5 Large-Scale Integration of Clean Technologies in the Power Grid

TABLE OF CONTENTS

HOMELAND SECURITY

- 5.1 Integrated Solutions for U.S. Bio/Agrodefense: National Agricultural Biosecurity Center
- 5.2 EPICENTER: Laboratory for a Network Science Approach to Predict and Control the Spread of Infectious Diseases; within the Network Science and Engineering (NetSE) Group

LABOR, HHS, EDUCATION

- 6.1 Fundamental Cancer Research
- 6.2 Overcoming the Healthcare Shortage: Pioneering a Physician Assistant Program that Focuses on the Underserved
- 6.3 Education Leadership in K-12 and Higher Education
- 6.4 Preparing Educators: Research and Learning
- 6.5 Military Connected Learners: Research and Teaching
- 6.6 Precise Image-guided Interventions for Cancer Treatment
- 6.7 Priority Zoonotic Animal Drugs
- 6.8 Research & Development for U.S. Bio/Agrodefense: Protecting Agriculture and Preserving Public Health
- 6.9 Improving Mental Health and Well-being by Building Healthy Relationships and Ending Violence
- 6.10 Attacking Cancer with Exercise
- 6.11 Cognitive and Neurobiological Approaches to Plasticity (CNAP) Center

MILITARY CONSTRUCTION, VETERANS AFFAIRS

- 7.1 Supporting Wounded Warriors
- 7.2 Overcoming the Healthcare Shortage: Pioneering a Physician Assistant Program that Focuses on the Underserved

TRANSPORTATION

- 8.1 Global Aeronautics Initiative
- 8.2 National Institute for Aviation Diversity
- 8.3 Central Archive for Transit Passenger Data (CATPAD)

Memorandum

DATE: February 12, 2020

TO: Members and Staff of the Kansas Congressional Delegation

FROM: Richard B. Myers, President Kansas State University



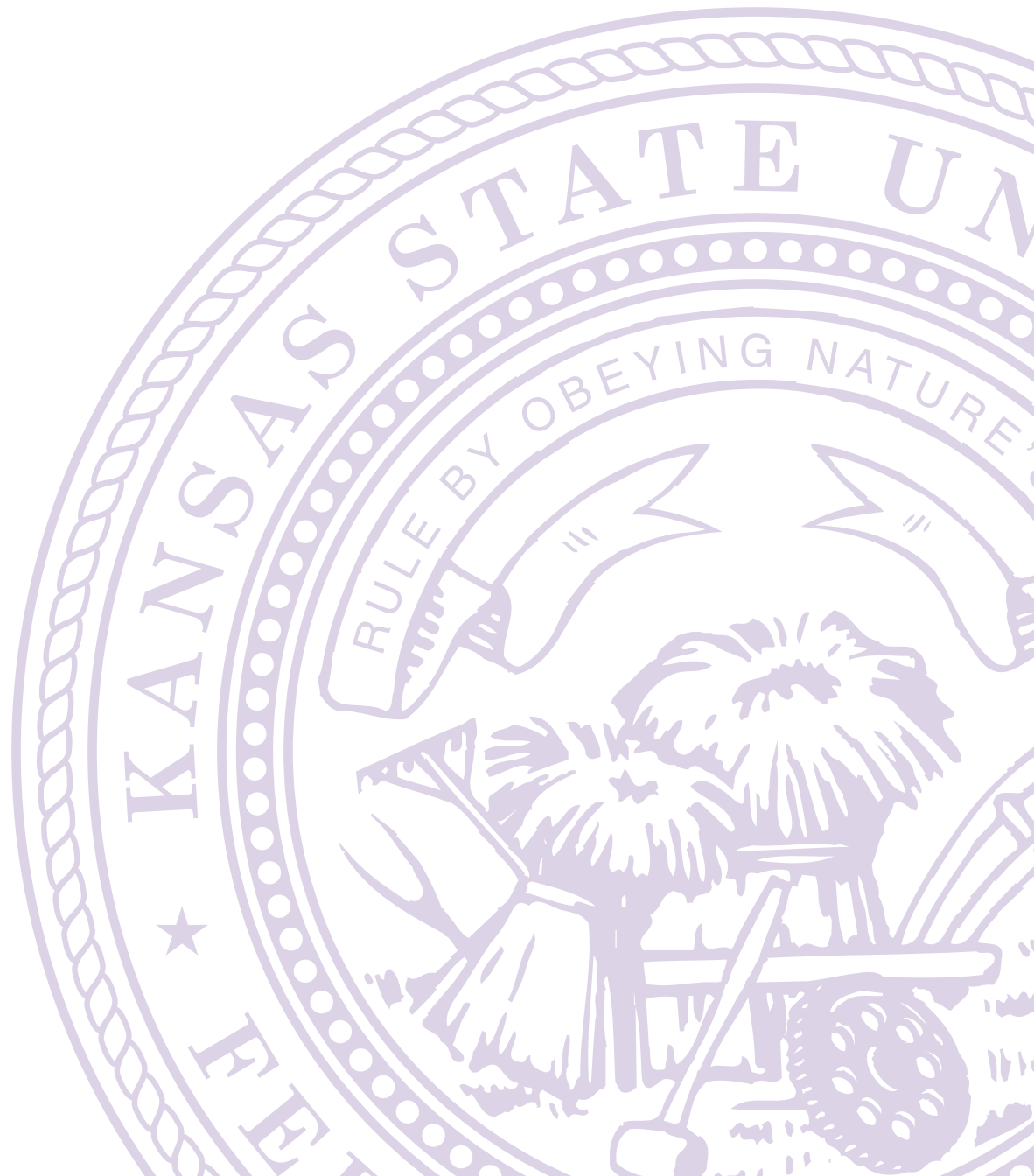
RE: Kansas State University Expression of University Strengths Document

On behalf of Kansas State University, I would like to thank each of you for your work for the citizens of Kansas. Your guidance and support has been valuable to assist the University in launching and enhancing programs and research efforts.

This document is presented to you as the Expression of University Strengths. The university faculty and staff believe these initiatives represent the strengths of the university and match federal initiatives and programs. In addition, these initiatives are in step with K-State 2025, the University's strategic plan.

If you have questions about any of these requests, please contact Sue Peterson, Chief Government Relations Officer, at 785-532-6221 or skp@k-state.edu. She will provide you with whatever information you may require. You may access this document electronically on the K-State Government Relations website at k-state.edu/govrelations/federal.

AGRICULTURE



College of Agriculture Research, Teaching, and Extension Facilities

Background

Kansas, the United States and the world rely on Kansas State University to provide the workforce and future leaders for all agricultural industries, from food crops to milling to livestock sciences to risk management. K-State is the premier university for research and career preparation of those who will feed the world. To ensure we fulfil this responsibility, it is imperative for the College of Agriculture to have modern facilities that lift our research and teaching capabilities to continue to fuel the innovation that feeds the world.

The most recently passed Farm Bill included a program to make competitive grants to assist in the construction, alteration, acquisition, modernization, renovation, or remodeling of agricultural research facilities at the nation's schools of food and agricultural sciences (Sec. 7503). A recent national study conducted by the Board on Agricultural Assembly of the Association of Public and Land-Grant Universities documented a deferred maintenance backlog of \$8.4 billion nationally at the nation's schools of agriculture. K-State recently conducted a master planning exercise that proposed to invest over \$250 million to upgrade College of Agriculture and Research and Extension facilities at the Manhattan campus.

Description

Faculty at K-State are internationally recognized in food and agriculture. The College of Agriculture is ranked 6th in the Nation (niche.com) and many high-demand degrees such as milling science can only be obtained at K-State. For the past several years, K-State's Agricultural Experiment Station expended more than \$100 million annually in research, which is more than 53 percent of the university's total research expenditures.

Eight mid-campus buildings house the College of Agriculture and range in age from 40 to more than 100 years old. K-State's Dairy Teaching and Research Center was opened in 1977, and no longer prepares students for the technology, animal care, and biosecurity needed for careers in the modern dairy industry. Failing infrastructure and out-of-date facilities jeopardize K-State's ability to meet the current and future global food and agricultural challenges.

The Explanatory Notes supporting the National Institute of Food and Agriculture 2020 budget request describes an increase of \$50 million for competitive facility grants at Land-Grant Universities. This new grant program:

- Seeks to address the aging and decrepit infrastructure and fixed equipment of land-grant universities, which currently conduct research in inadequate and often deteriorating 19th and 20th century facilities.

- Contributes to reducing a backlog of around \$8.4 billion for the renovation or replacement of older mission-critical buildings, laboratories, animal and plant research houses/farms, greenhouses, and pilot facilities.
- Invests in the future of America's global preeminence and competitiveness, and directly affects the future of the quality, safety, and integrity of food and agricultural research, teaching, and extension.

K-State is prepared to meet the required 50-percent match with non-federal dollars and is confident that the College of Agriculture Facilities Master Plan fulfills the intent of the competitive facilities grant program.

Relevance

During the past 10 years, the number of students in the college has increased by more than 25 percent. In addition, nearly 100 percent of graduates college-wide find excellent jobs, nearly 60% of them in Kansas. The U.S. Department of Agriculture expects the demand for future agricultural graduates will continue to grow.

To capitalize upon our existing strengths in food and agricultural research, and to address critical infrastructure needs, we propose the comprehensive and strategic renovation and construction of agricultural research facilities at K-State.

The K-State College of Agriculture Facilities Master Plan seeks to address the College of Agriculture's most urgent facility needs and deferred maintenance concerns, and provide state-of-the-art facilities through a combination of new construction and renovation to support the College's education, research, and extension mission.

K-State is the only place that provides cutting-edge agricultural resources, support and opportunities to Kansans. We must discover, develop and deploy new solutions by maintaining and improving a robust research and education enterprise. To ensure we meet the needs of the Kansas agriculture industry and prepare for increasing demands for innovation, K-State's scientific workspaces — its working laboratories, animal research facilities, classrooms, greenhouses, and mission-critical buildings — must be modernized to 21st-century standards.

Agency Contact Information

USDA NIFA
Director
Kansas City, MO

Agriculture Advanced Research and Development (AgARDA)

Background

The recently enacted Farm Bill includes Section 1473H Agriculture Advanced Research and Development Authority (AgARDA) Pilot. The intent of AgARDA is “to develop and deploy advanced solutions to prevent, prepare, and protect against unintentional and intentional threats to agriculture and food in the U.S.” It’s authorized at a level of \$50 million per year, but no funding has been appropriated to date.

AgARDA is intended to drive agricultural innovation just as the Defense Advanced Research Projects Agency (DARPA) does for the Department of Defense (DoD). DARPA and other similar non-DoD programs served as models for AgARDA.

K-State has broad capabilities of relevance to AgARDA and, thus, funding of this program could provide significant benefits to both the university and the nation. In partnership with six of the nation’s top land-grant universities, K-State is a leader with the newly-formed *Coalition for Epi Response Engagement and Science*, CERES.

The U.S. agricultural industry has experienced significant loss from infectious disease outbreaks in animals and plants caused by pathogens. Although awareness and planning to improve response to infectious disease outbreaks has increased, significant gaps remain.

To address these gaps, the CERES integrates and leverages the strengths and assets of these land-grant universities and other stakeholders, resulting in new opportunities, ideas, and practices, through collaborative engagement. Funding AgARDA would enable K-State and CERES to address the gaps.

Description

In AgARDA, the term “*advanced research and development*” (R&D) is defined as R&D activities used to address research challenges in agriculture and food through —

- (A) targeted acceleration of novel, early stage innovative agricultural research with promising technology applications and products; or
- (B) development of qualified products and projects, agricultural technologies, or innovative research tools.

The term “qualified product or project” means —

- (A) improved methods for growing, harvesting, handling, processing, storing, packing, and distributing agricultural products;
- (B) plant disease or plant pest countermeasures to intentional or unintentional biological threats; or
- (C) veterinary countermeasures to intentional or unintentional biological threats.

K-State has exceptional R&D strengths in all of these areas, particularly in the Colleges of Agriculture, Arts & Sciences, and Veterinary Medicine.

Relevance

The goals of the AGARDA are —

- (A) to develop and deploy advanced solutions to prevent, prepare, and protect against unintentional and intentional threats to agriculture and food in the United States;
- (B) to overcome barriers in the development of agricultural technologies, research tools, and qualified products and projects that enhance export and other competitiveness, environmental sustainability, and resilience to extreme weather;
- (C) to ensure that the United States maintains and enhances its position as a leader in developing and deploying agricultural technologies, research tools, and qualified projects and products that increase economic opportunities and security for farmers, ranchers, and rural communities; and
- (D) to undertake advanced research & development in areas in which industry by itself is not likely to do so because of the technological or financial uncertainty.

As already noted, K-State has broad capabilities of relevance to AgARDA and, as a result, our faculty will be highly competitive in the advanced R&D programs. These include world-class scientists developing:

- improved methods for growing, harvesting, handling, processing, storing, packing, and distributing agricultural products;
- plant disease and plant pest countermeasures to intentional or unintentional biological threats; and
- veterinary countermeasures to intentional and unintentional biological threats.

Those cover all areas of AgARDA advanced R&D.

To support the critical research necessary to protect America, we request that Congress appropriate the \$50 million annually that is authorized in the Farm Bill.

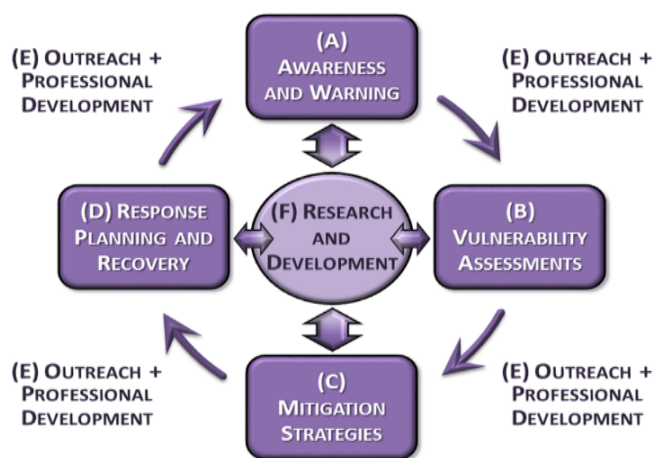
Agency Contact Information

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National Plant Diagnostic Network – NPDN

Background

Protecting American agriculture – crops, livestock – and food from global biothreats, while safeguarding people from zoonotic animal diseases and foodborne pathogens, is vital to U.S. homeland security. As a result, Homeland Security Presidential Directive-9 (HSPD-9) was issued Jan. 30, 2004. The major requirements delineated in HSPD-9 include: (A) *awareness and warning*; (B) *vulnerability assessments*; (C) *mitigation strategies*; (D) *response planning and recovery*; (E) *outreach and professional development*; and (F) *research and development*.



Public Law 115-43 in 2017 amended the Homeland Security Act of 2002 to codify mandates of HSPD-9 in federal statute for the U.S. Department of Homeland Security (DHS). Plus, National Security Presidential Memorandum/NSPM-14, Sept. 18, 2018, stipulates continued adherence to HSPD-9 by federal agencies.

The most recent Cooperative Agreement between the Land-grant universities that administer NPDN and USDA, calls for substantial new programs without additional resources. To meet the new USDA requirements necessary to protect agricultural plant systems and support APHIS PPQ in safeguarding trade, additional investment is critical to meet the steadily increasing demands for rapid and accurate plant diagnostics.

Description

K-State's (KSU's) College of Agriculture (COA) is home to the Regional Center of Great Plains Diagnostic Network (GPDN), a nine state consortium of plant diagnostic laboratories including, Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma and Texas. GPDN is one of the five regional networks of the National Plant Diagnostic Network (NPDN). NPDN is comprised of over 70 labs nationally that together constitute critical components of our national biosecurity infrastructure.

The GPDN Regional Center provides administrative oversight and diagnostic technical and surge support to the region. In addition, the lab information management system (PDIS software) used by 32 states was developed and is supported by GPDN. PDIS facilitates sample tracking and data upload to the NPDN National Data Repository. GPDN sponsors training and education for diagnosticians to maintain proficiency with advanced diagnostic technologies and achieve competence with approved standard operating procedures. The GPDN Director provides national and regional leadership (immediate past NPDN Executive Director) to oversee the implementation of policies and procedures to enhance performance, increase capabilities and capacity, and to improve stakeholder support.

GPDN maintains strong working relationships with state and federal regulatory agencies to partner in protecting plant systems. Over the past several years, GPDN has partnered with USDA APHIS PPQ to support response efforts for several introduced pests and pathogens with the potential to negatively impact productivity and profitability of Kansas agriculture and/or disrupt export of Kansas commodities.

GPDN and NPDN were created as called for in HSPD-9 and as such, contribute to (A) awareness and warning, (D) response planning and recovery, and (E) outreach and professional development. GPDN and NPDN provide triage and surge support to APHIS PPQ; GPDN serves as a primary mechanism to facilitate the early detection of newly emerged and/or introduced pathogens and pests. GPDN and NPDN benefit plant and animal health in the region and nationally by protecting the crop systems that generate the feed to support our livestock operations.

Relevance

America is unprepared for accidental introductions or bioterrorism attacks on U.S. agriculture – crops, livestock – and food. Multiple unintentional disease outbreaks in recent years prove that to be the case. Greatly improved *Awareness and Warning* is needed.

Proposed Action

Federal support of HSPD-9, PL 115-43, and NSPM-14 must extend beyond authorization into action. Bio/agrodefense requires federal agency *"budget submissions ... for defense of the U.S. food system."* (HSPD-9 element/edict #26) and appropriations.

Agency Contact Information

USDA NIFA
Director
Kansas City, MO

National Animal Health Laboratory Network

Background

Homeland Security Presidential Directive-9 (HSPD-9), Defense of U.S. Agriculture and Food, states that America's agricultural and food sector is vital to our economy and is one of the key underpinnings of national security and thus it must be protected from disruption by natural, accidental, or deliberate events. HSPD-9 also directed a number of federal agencies to work together to provide a unified strategy to protect our agriculture sector and to improve coordination with and among the states. More specifically, the directive states that these agencies should "...develop nationwide laboratory networks for food, veterinary, plant health, and water quality that integrate existing Federal and State laboratory resources, are interconnected, and utilize standardized diagnostic protocols and procedures." The passage of the Securing our Agriculture and Food Act in June 2017 supports HSPD-9 to ensure coordination to protect agriculture. Historically, the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) has served as the vanguard to protect America's pre-harvest resources. The National Animal Health Laboratory Network (NAHLN) represents a cooperative effort between two USDA agencies: APHIS and the National Institute of Food and Agriculture (NIFA), and the American Association of Veterinary Laboratory Diagnosticians (AAVLD). The NAHLN is a network comprised of approximately 59 laboratories across the United States that focus on preparedness and surveillance for high-consequence diseases (primarily foreign animal diseases). NAHLN laboratories use the same testing methods and procedures and similar software platforms to perform surveillance testing and high throughput testing in the case of an outbreak of an emerging disease or foreign animal disease. Resources estimate that an outbreak of Foot and Mouth Disease in the United States would cost the economy approximately \$20 billion and be felt across multiple sectors. NAHLN laboratories are important in prevention and control, thus the 2018 Farm Bill has allocated mandatory funding to support the NAHLN infrastructure.

Description

The NAHLN provides a high throughput diagnostic protocol to facilitate rapid and accurate examination of samples from diseases of importance to food animal security. Kansas State University (KSU) has participated with NAHLN in significant ways, including the Kansas State Veterinary Diagnostic Laboratory (KSVDL). These include the development, enhancement and delivery of targeted technical training support programs, with: 1) exercises and reviews of best practices from NAHLN labs; 2) expanded animal health

diagnostic screening capabilities regionally; 3) participated in proficiency testing personnel and conducting surveillance testing for CSF, ASF, FMD, APMV-1, HPAI, SIV, CWD, Scrapie, PRV, and emerging diseases; 4) increased testing capacity of the KSVDL by conducting research on new methodologies; 5) development of training strategy framework for NAHLN laboratories by assessing lessons learned; and 6) in the occurrence of an outbreak, perform post-surveillance testing to ensure disease freedom in affected areas.

Relevance

At the Federal level, USDA's National Veterinary Services Laboratories (NVSL) and Foreign Animal Disease Diagnostic Laboratory (FADDL; Plum Island Animal Disease Center) serve as the national veterinary diagnostic reference and confirmatory laboratory. The State and University laboratories, such as KSVDL in the NAHLN perform routine diagnostic testing for endemic animal diseases as well as targeted surveillance and response testing for foreign animal disease investigations/outbreaks and other high-consequence diseases. State and University laboratories also participate in the development of new assay methodologies and are on the frontline of detecting emerging diseases important in animal and/or human health (zoonoses). KSVDL became a first-tier NAHLN lab in 2019; 17/59 laboratories across the US are tier 1. Prior to 2019, KSVDL had been a tier 2 laboratory since the NAHLN was established in 2002.

Networking these resources provides an extensive infrastructure of facilities, equipment, and personnel that are geographically accessible no matter where disease strikes. The laboratories have the capability to conduct nationwide surveillance testing for the early detection of an animal disease outbreak. The ability to test large numbers of samples rapidly during an outbreak and then to demonstrate freedom from disease after eradication is critical and requires enhanced capacity nationwide. This can only be accomplished with a strong and responsive NAHLN. Continued funding and additional funding are critical for the function of NAHLN in protecting U.S. animal agriculture.

Agency Contact Information

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The Wheat Genetics Resource Center Industry/University Cooperative Research Center (WGRC IUCRC)

Background

Established in 2013, the Wheat Genetics Resource Center Industry/University Cooperative Research Center (WGRC IUCRC) at Kansas State University joins public and private partners to mobilize genetic diversity to enhance wheat yield and meet food security needs. Researchers at the WGRC IUCRC deliver novel genes, derived from wild wheats, to public and private breeding programs. These genes combat challenges facing wheat farmers, such as hot and dry climate conditions, pests, and disease, to ensure a stable and profitable wheat supply that keeps up with global demand. The WGRC IUCRC also targets genes related to consumer-demanded nutritional, flavor and textural profiles. Beyond scientific deliverables, the WGRC IUCRC provides a transdisciplinary, applied and fundamental research environment to train the future leaders of crop improvement research.

Description

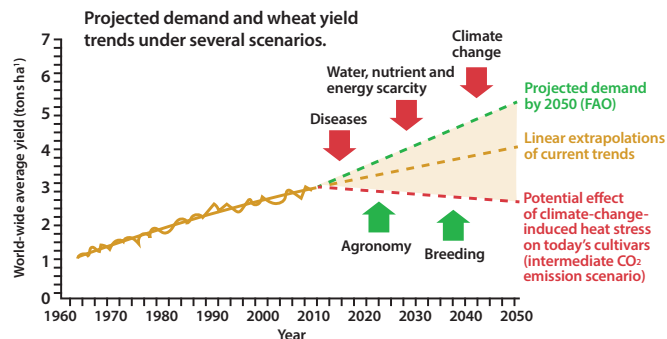
Kansas State University requests \$750,000 per year for five years to be matched by industry investors and the National Science Foundation. The funding will go toward the core research program of the WGRC IUCRC:

- Managing wheat germplasm
- Mining the wheat gene pool
- Wheat phenotyping for drought
- Wheat genetic stocks and introgression platform, and
- Graduate student training

This core research program enhances the value of the WGRC wild wheat collection to the user community, leading to rapid development of new, high-yielding wheat varieties and value-added food products.

Relevance

- Temperature increases are projected to decrease wheat yields by 20-30 percent.
- Demand for wheat is expected to increase by 60 percent over the coming decades.
- The current trend of wheat yield cannot meet the projected global demand in 2050.



— CGIAR WHEAT, 2014

The WGRC IUCRC provides novel genes to breeders to develop wheat varieties for farmers that can resist pressures such as disease, water, nutrient, and energy scarcity, and climate change.

The core research program of the WGRC IUCRC has three main missions to address challenges facing the global wheat supply:

- 1) *Collect, conserve, and utilize germplasm in crop improvement:* The Center has delivered the germplasm release Wsm3 which is a gene offering a novel source of resistance to Wheat Streak Mosaic Virus. This disease caused \$75 million in damage to wheat crops in Kansas in 2017 and \$109 million in 2006.
- 2) *Create and promote the exchange of materials, technology, and new knowledge in genetics and biotechnology:* The WGRC IUCRC team has produced 19 publications and 2 patents/invention disclosures.
- 3) *Train undergraduate, graduate, and postgraduate students and visiting scientists:* WGRC has mentored 13 Master's students, 25 Ph.D. students, and 20 post-doctoral fellows, in addition to having hosted more than 60 visiting scientists from all over the globe.

Our collection

4,000 WILD WHEATS 3,500 UNIQUE GENETIC STOCKS 8,500 MAPPING POPULATIONS 55 GERmplasm RELEASES UTILIZED IN BREEDING PROGRAMMES IN 45 COUNTRIES AND 39 STATES

Agency Contact Information

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Addressing the Antimicrobial Resistance Challenge

Background

Antibiotics have been transformational medicines in human and animal health. There are currently over 200,000 concentrated animal feeding operations (CAFOs) in the U.S. Individual livestock CAFOs can have more than 1,000 head of cattle, while a single poultry CAFO can have in excess of 100,000 birds. This density, and the associated economies of scale, have dramatically lowered food prices and made the U.S. a major food exporter around the world. It is only possible because of antibiotics; without them, a single infected animal could quickly wipe out an entire CAFO operation.

Over time, pathogens can develop complete resistance to a given antibiotic. Unfortunately, multi-drug resistance in bacteria is becoming widespread, especially due to extensive use in agriculture. Resistance threatens to abolish all of the gains antibiotics have brought.

Microbial resistance to control agents is not limited to antibiotics; it extends to drugs used to combat diseases caused by viruses (e.g. HIV/AIDS) and parasites (e.g. malaria). Increasing populations, global travel, global trade, the spread of urbanization, and widespread use of technology present additional challenges. They combine to drive the fastest pace of emergence of novel pathogens in recorded human history. Many of these pathogens are zoonotic, previously limited to domestic or wild animals, but now infecting people. A particular challenge of emerging infectious agents is the lack of tools for detection, control, and prevention.

Description

In September 2017, the Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria (PACCARB) issued a report, *Recommendations for Incentivizing the Development of Vaccines, Diagnostics, and Therapeutics to Combat Antibiotic-Resistance*. The Council noted that a variety of economic, research and development, regulatory, and behavioral hurdles must be addressed to accelerate the pace of new tool discovery to fight antimicrobial resistance. A key recommendation was to establish a formal entity, or coordination hub, to accelerate vaccine development, therapeutics, and animal health diagnostics.

This entity, which PACCARB proposed to be administratively housed within USDA, would serve as a “one-stop-shop” for researchers, companies, and universities to advance their technologies from discovery to commercialization. The new unit would establish connections to accelerate research, development, and tech transfer for new vaccines, diagnostics, and alternatives to antibiotics.

In July 2018, Iowa State University was competitively selected by two national organizations, the Association of Public and Land-grant Universities (APLU) and the Association of American Veterinary Medical Colleges (AAVMC) to be that hub and host the National Institute of Antimicrobial Resistance Research and Education (NIAMRRE). NIAMRRE provides local, national and international leadership in combating antimicrobial resistance and drives collaborative and integrative research, education, and engagement to solve antimicrobial resistance challenges.

Kansas State University has been invited to join and is an ideal partner in NIAMRRE. K-State has collaborations with companies in the Animal Health Corridor and close proximity to the National Bio and Agro-defense Facility now under construction.

Relevance

NIAMRRE is in keeping the five goals articulated in the 2018 National Biodefense Strategy (NBS) for strengthening the biodefense enterprise, including to “Strengthen biosafety and biosecurity practices and oversight to mitigate the risk of bioincidents” (2.1.2), and “Ensure a vibrant and innovative national science and technology base to support biodefense” (3.1).

Specifically, our near-term goals include addressing the current 60:1 funding disparity between human AMR-related research and AMR-related research in all other health sectors (livestock, companion animal, environment) without decreasing human funding. Two focal areas for consideration are:

- Increase research funding opportunities that NIAMRRE partners can collectively or individually compete for by advocating for increased antibiotic-designated appropriations to USDA-NIFA, and
- Increase funding directed at leveraging the infrastructure of NIAMRRE and our partner institutions to build capacity around education and outreach via directed appropriations to FDA to support efforts outlined in their FY19-23 goals document, Supporting Antimicrobial Stewardship in Veterinary Settings.

Agency Contact Information

Veterinary Science Policy Advisor
USDA Office of the Chief Scientist
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Rural Economic Development Through Youth Entrepreneurship

Background

While higher education still provides access to quality employment for many, finding a good job is not as easy for those who want to live and work in rural communities. In addition, as the students with greater potential for academic credentials move away from rural economically depressed areas to advance in their careers, our small towns and communities are left without the resources and population needed to survive. As we begin to see the negative impacts from the changing economy and environment of our rural areas, one solution is to encourage entrepreneurship and new venture creation as a viable career option for our youth.

Description

Kansas State University is well-positioned to capitalize on existing strengths to provide critical educational and programmatic support to aspiring middle school and high school entrepreneurs in rural areas around the country to support economic development. Through existing programs like the Kansas Entrepreneurship Challenge, Launch A Business, and Startup School, the Center for the Advancement of Entrepreneurship has a track record of success in developing and offering world class entrepreneurship education curriculum, garnering local support for youth entrepreneurship in communities around the state, and creating energizing events and programs to help inspire young entrepreneurs to pursue their entrepreneurial goals. K-State is uniquely capable of developing and offering the resources young aspiring entrepreneurs need to help revitalize rural communities across the country.

By leveraging the success and momentum of the Kansas Entrepreneurship Challenge, K-State proposes a youth entrepreneurship initiative that will partner with high schools, middle schools, and economic development agencies across the country to provide entrepreneurship education and support to aspiring young entrepreneurs. These resources include an online curriculum with world-class videos, worksheets, and collaboration tools for business model and plan development to be utilized in the classroom or home of aspiring entrepreneurs. The initiative will provide guidance and support for local mentoring and entrepreneurship competitions. A culminating event will be held annually which will include a competition featuring the top entrepreneurial ideas, workshops, mentoring, and keynote speakers.

Potential Impact

Developing opportunities for youth to learn about entrepreneurship has numerous impacts on young entrepreneurs and their communities including:

- Generating awareness and excitement for entrepreneurship and new venture opportunities in local communities
- Student networking opportunities as entrepreneurial-minded students from different parts of the region meet and develop relationships
- Economic impact through the launch of new ventures in our rural communities

Additional developmental impacts are also likely realized by all students who participate in the program. According to the National Foundation for Teaching Entrepreneurship, entrepreneurship education benefits include: 44% increased occupational aspirations, 32% increased interest in attending college, 8.5% increase leadership behavior, and 4% increased independent reading.

Agency Contact Information

USDA, Office of Rural Development
Bette Brand
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Food Animal Residue Avoidance and Depletion (FARAD) Program

Background / Description

The Food Animal Residue Avoidance and Depletion (FARAD) program is an integrated extension and applied research program that maintains the Food Animal Residue Avoidance Databank, which is designed to eliminate adverse drug and chemical residues from appearing in the edible tissues of food-producing animals. FARAD helps keep food animals healthy and safe for human consumption through outreach activities that include a telephone hot-line (1-888-USFARAD), website for requests by veterinarians for direct residue avoidance assistance (www.FARAD.ORG), and mobile applications for field use. FARAD is a veterinary tool designed to keep adverse levels of drugs and chemicals from contaminating milk, meat and eggs destined for human consumption. No other federal or private entity duplicates work carried out by FARAD. FARAD straddles the missions of USDA (agriculture research and extension) and FDA (food safety). FARAD is an integrated extension and applied research program that provides required, scientifically valid information on how to avoid drug, environmental and pesticide contaminant residues in milk, meat and eggs, thus helping to avert food safety crises. FARAD provides the scientific basis for determining the appropriate withdrawal interval when drugs are used in an extra-label manner, a scenario often employed when veterinarians are trying to reduce antimicrobial resistance in animals they treat. The research component of this program involves development of mathematical models that predict withdrawal times that can be used real time by veterinarians in field situations. FARAD publishes handbooks and journal digests of these data to increase availability to practitioners, as well as contributing technical manuscripts to the peer-reviewed scientific literature of this field. FARAD is also used when food-producing animals are mistakenly exposed to environmental contaminants (e.g., pesticides, biotoxins, melamine, etc.), or, for example, to nuclear fall-out eight years ago from the Fukushima reactor disaster in Japan. FARAD provides veterinarians with a legal mechanism for determining withdrawal intervals for extra-label drug use or contaminant exposures. Because it is often not economically viable for pharmaceutical companies to pursue a drug label claim for minor species, FARAD is the only source for food safety and drug withdrawal information for veterinarians treating these particular species (e.g., sheep, goats, reindeer, elk, ducks, pheasant, quail, rabbits, fish, shrimp, and honeybees). Veterinarians often must use drugs approved for both animals and humans to address animal health and welfare and to enhance public safety. Public Law 103-396, Animal Medicinal Drug Use Clarification

Act (AMDUCA), authorized in 1994, permits veterinarians to prescribe drugs in an extra-label manner to treat conditions for which there are no effective approved drugs. AMDUCA requires a scientifically derived withdrawal interval for drugs used in an extra-label manner. FARAD is the only approved source for such information and in fact enables much needed drug usage in food animal practice. FARAD serves as the veterinarian's clearing house for residue data.

Relevance

The FARAD program was developed in 1981 by pharmacologists and toxicologists at four land-grant universities. Dr. Jim Riviere, emeritus faculty member of the College of Veterinary Medicine at Kansas State University, is one of the co-founders of this program. Presently, FARAD is overseen and operated by faculty and staff within the Colleges of Veterinary Medicine at Kansas State University, University of California at Davis, University of Florida, North Carolina State University, and Virginia-Maryland College of Veterinary Medicine. FARAD continues to serve as the primary resource for veterinarians to maintain a drug and chemical residue free food supply. In 2018, FARAD received 3,645 calls, which represented a 1% increase in residue avoidance cases compared to 2017. Calls are very diverse and range from "ordinary requests" for drug withdrawal recommendations (related to extra-label drug use often to reduce potential for antimicrobial resistance, or after accidental drug overdoses) to "extraordinary requests", which include pesticide and contaminant exposures (e.g., oil products spilled from freight trains), as well as disasters such as hurricanes. The global veterinary drug residue avoidance database effort continues to be pursued, a development which would greatly impact the food safety community, and provide direct support for Kansas beef exporters.

Agency Contact Information

USDA NIFA
Director
Kansas City, MO

Rural Stress and Mental Health

Background

It is well understood that our society and culture are creating increasing amounts of stress on a national level. When we look closer at the levels of stress on rural communities, it is readily apparent that social, financial, community, and farming stressors are intensified. Moreover, the current downturn in the farm economy for the past five years has no short-term resolution in sight and is a significant source of stress. With low commodity prices, high expenses, and disruptions of foreign trade, many Kansas agricultural operators have suffered deep financial losses, liquidations, and bankruptcy. The oppressive stress associated with these conditions affects decision making, family relationships, and the ability to explore options and generate solutions. Lenders and other businesses that finance and support these operations are also affected. Sometimes, the unrelenting stress challenges the mental health of individuals causing them to question their own self-worth and purpose. As a result, the suicide rate continues to climb. In 2017, there were 544 suicides in Kansas alone. This robs Kansas of approximately 17,273 years of life lived and the love and companionship of a family. It is impossible to count the cost in terms of personal pain, heartache, relationships, future potential, and economic loss.

Description

To address these issues, applied research, clinical services, and programming are underway across colleges at Kansas State University. For example, a faculty member in the School of Family Studies and Human Services is assessing the efficacy of extending Eye Movement Desensitization and Reprocessing therapy beyond trauma to include mental health outcomes. Recently, the College of Health and Human Sciences hired a faculty member for the new Physician Assistant Program who will provide mental health services in rural communities. In addition, K-State Research and Extension (KSRE) supports the Kansas Agricultural Mediation Services (KAMS), which has been a safe and confidential place to call for assistance for 31 years as the USDA Certified State Agricultural Mediation Program for the State of Kansas. Funded by a federal grant administered by USDA, KAMS provides free or low-cost services to assist farm families develop a plan to work through the issues they face. KAMS services include: mediation, farm financial counseling, and legal assistance.

Relevance

Over the last five years, the average net farm income for Kansas Farm Management Association farms has often been less than their family living expenses. The current downturn in the ag economy is expected to continue for the foreseeable future. Thus, working to reduce rural stress and improve the mental health of our rural community is becoming one of the most important aspects of working toward a healthy rural America, but it will take everyone working together.

Agency Contact Information

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National Institute of Food and Agriculture
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The Center for Food Safety in Child Nutrition Programs

Background

The United States Department of Agriculture's Food and Nutrition Services (FNS) provides healthy meals to more than 31 million children each day in over 100,000 schools through the School Lunch Program and about 3.2 million children and 112,000 adults are served daily through the Child and Adult Care Food Program. The safety of these meals is of great importance and there is strong Federal legislation to support food safety.

As part of their response to a direct initiative of the Secretary of Agriculture, Tom Vilsack, USDA FNS established The Center of Excellence for Food Safety Research in Child Nutrition Programs at Kansas State University in 2011. Kansas State University was selected to administer the inaugural Center through a competitive process. In 2017, Kansas State was again selected to administer the Center for Food Safety in Child Nutrition Programs after a competitive selection.

Description

The Center provides science-based evidence to improve the safety of foods provided through the FNS nutrition assistance programs, particularly those served in schools and childcare settings. The Center team conducts research that directly impacts the safety of food served in child nutrition programs. A multidisciplinary approach is used to conduct basic and applied research to resolve food safety issues in schools and other child nutrition programs. The findings have been translated to training and other resources to improve the knowledge and practices of school foodservice directors and program operators, scientists, policy makers, educators and practitioners.

Faculty from the Department of Hospitality Management and the Department of Food, Nutrition, Dietetics, and Health in the College of Health and Human Sciences provide leadership for the Center. The Center has received a total of \$5.8 million for the nine years that it has been funded. Continuation of the Center will depend on FNS priorities and funding availability.

Relevance

Kansas State University offers food safety expertise along the entire continuum of the food chain that is unparalleled in any university nationally. Recent research initiatives include:

- **Employee Behavior Assessment:** Determine school nutrition employees' behavioral intentions to follow food safety practices and develop interventions to improve employee practices and the safety of food served.
- **Food Defense:** Identify current practices to prevent intentional acts of food contamination or tampering in school nutrition programs and assess deficiencies in practices, providing recommendations for education and training resources.

- **Microbial Growth:** Use microbiological testing and pathogen modeling to determine microbial growth in food commonly served in child nutrition programs.
- **Summer Food Service Programs:** Identify proper and improper food safety practices in Summer Food Service Programs to identify targeted areas of improvement for educational interventions.
- **Child Care:** Identify food safety regulations and operational characteristics of childcare center and in-home operations participating in the Child and Adult Care Food Program and determine food safety education and training needs.

This applied research is used by FNS to inform public policy. The Institute of Child Nutrition (funded by FNS and housed at the University of Mississippi) uses the results as the basis for educational programs and materials for child nutrition programs across the United States. This collaborative relationship ensures that the research is translated into meaningful resources that have a direct, positive impact on practice.

The Center also developed an intensive immersion program to improve food science and food safety competencies in school nutrition programs. The course, delivered to management staff in school nutrition programs and state agencies, helps participants learn to establish and foster a food safety culture and expands their understanding of food science as it applies to their programs. Participants are challenged to return to their home state and educate other child nutrition managers and directors utilizing the tools and knowledge they have gained from the course. Since 2013 approximately 300 people from 49 states have completed the program. Alumni have indicated that they have used the knowledge gained to reach an additional 20,000 individuals engaged in child nutrition programs.

The work of the Center is enhanced through partnerships with the many programs and institutes at Kansas State, including the Biosecurity Research Institute, Food Science Institute, Kansas State University Olathe, and with the Kansas Department of Education's Division of Child Nutrition and Wellness.

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Center for Sensory Analysis and Consumer Behavior

Background

Satisfying, safe, and healthful products throughout the life span are essential to consumers in the U.S. and around the world. Considerable data show that people generally choose to eat foods and use other consumer products over the long term only if they like them. Because the quality of life of our citizens is partly dependent on the products they choose, and because sales and export of successful products influence the profits from farms and industries, understanding how to create the best products is essential.

Description

The Department of Food, Nutrition, Dietetics and Health at Kansas State University (KSU) houses the #1 ranked Sensory Analysis program in the world, graduating quality Masters and Doctorate students in a highly competitive market (rankings determined by *Journal of Sensory Studies*, a primary research journal in the field).

The Center for Sensory Analysis and Consumer Behavior has provided confidential, effective solutions for more than 100 domestic and international companies. The Center has tested the appearance, taste, odor, and texture of foods; the visual and touch aspects of textiles; the odor, feel, and performance of personal care products such as shampoo and cosmetics; the visual and touch aspects of computers and many other consumer products.

Almost 50% of sensory professionals worldwide work in non-food businesses, but KSU's Sensory Analysis and Consumer Behavior program is the only sensory program in the world to offer courses in products other than food and was the first university sensory program to publish in fields such as pet food, textiles, cosmetics, and computers.

Why is this field of science important? Although cost, convenience, and health/nutrition are important in food choice, "taste" reigns supreme. These sensory-derived decisions critically important because they impact health, culture, the economy, satisfaction, mental states, etc.

Regardless of the product, service, or information being tested, our mission is to apply sensory science, including consumer research, to discover solutions, train students, conduct applied research, and provide outreach to consumers, companies, and government policymakers.

Improving the initial sensory quality of products, maintaining quality during storage, sustaining repeated product purchase/consumption, enhancing sustainability, enhancing safety and nutrition education, and understanding life-style choices as they affect product consumption are major thrusts of the Sensory Analysis and Consumer Behavior program at Kansas State University.

Relevance

The Center for Sensory Analysis and Consumer Behavior at KSU is the oldest and largest university/industry collaborative applied sensory research center in the world. There are continuing projects with industry to evaluate foods and beverages, pet foods and pet care, personal care products, pharmaceuticals, textiles, automobile components, and services and information for consumers at home and away from home. Many of those have direct impact on state and regional industries, and impact national and international availability of products.

KSU has conducted developmental research to help understand sustained product satisfaction and help predict market success. There is on-going research evaluating consumer information on health and nutrition and innovative projects examine why consumers choose specific products such as grains, milk, meat, textiles, and tablet computers. The Center has also studied how consumers provide feedback about products in order to identify what attributes are driving consumers' perceptions and acceptance of the product, which has been valuable during product reformulations to become "clean label." This produces a large contingent of highly educated graduate students for internships and employment and engages faculty who have numerous collaborations with national and international industries, government, non-profits, and other academic institutions.

Agency Contact Information

USDA NIFA
Director
Kansas City, MO

Pre-Harvest Food Safety and Security

Background/Description

The goal of this program is to develop strategies to identify and mitigate food-borne pathogens and antimicrobial resistance in beef production systems. Specifically, studies will focus on the ecology of Shiga toxin-producing *Escherichia coli* (STEC), both O157 and non-O157 serotypes, *Salmonella*, *Campylobacter*, and antimicrobial resistance elements in beef cattle and on the development and testing of on-farm mitigation strategies, with the long-term goal of enhancing food safety and public health. Because of the economic importance of beef production and beef processing in Kansas, as well as Kansas State University's leadership in beef cattle research, it is logical for researchers to focus on food-borne pathogens and pre-harvest beef safety. The research outcomes will have major positive impacts on public health, animal wellbeing, and the economic prosperity of the state of Kansas and the U.S.

Relevance National/Regional

The food supply in the United States is one of the safest in the world; however, food-borne illnesses do occur and frequently are associated with foods of animal origin. The College of Veterinary Medicine at K-State has an interdisciplinary research team to address scientific issues related to the four vital areas in pre-harvest food safety in beef cattle: STEC (O157:H7 and non-O157), *Salmonella*, *Campylobacter*, and antimicrobial resistance of food borne and normal gut bacteria. The team with microbiology, molecular biology, epidemiology and production systems expertise, with collaborations with researchers from other departments at K-State, and input from key industry stakeholders is generating valid and industry-relevant outcomes. The long-term research goals are to understand the ecology of food-borne pathogens in cattle and their environment and develop effective and practical strategies for comprehensive reduction or elimination of food-borne pathogens at the farm level.

Shiga toxin-producing *E. coli* (STEC): Healthy cattle are the major reservoir of STEC, with the organisms residing primarily in the hindgut. These bacteria are shed in the feces, which then serve as a source of contamination of beef, produce, and recreational and drinking water. Research efforts in the past have focused primarily on STEC O157:H7. Recently, there is increased recognition that six other STEC serogroups, O26, O45, O103, O111, O121, and O145, are also major public health concerns. According to the CDC, the non-O157 STEC serogroups account for twice as many illnesses as STEC O157. However, not much is known about the ecology of the non-O157 STEC in cattle and their environment. Data on prevalence and factors affecting fecal shedding of these serogroups in the cattle population are needed before strategies for their control can be developed.

***Salmonella*:** The presence of *Salmonella* in beef cattle production systems can cause serious adverse effects in cattle as well as humans. In cattle, *Salmonella* can affect morbidity, mortality, production efficiency, and the economic well-being of cattle producers. *Salmonella* is a common cause of gastroenteritis in humans with outbreaks and infections often linked to consumption of contaminated beef, water or other foods. The emergence and dissemination of multi-drug resistant *Salmonella* are also major concerns for public health. The research goals are to understand the ecology and epidemiology of *Salmonella* in cattle.

***Campylobacter*:** The species of *Campylobacter* cause enteritis, mastitis and in some instances abortion in cattle. However, the importance of *Campylobacter* is as a food-borne pathogen that can cause sporadic cases and outbreaks of human *Campylobacter* infections. In the past, human infections have chiefly been attributed to poultry sources. Recently, cattle have been recognized as an important source of food contamination. The research goals are to understand the ecology and epidemiology of *Campylobacter*.

Antimicrobial Resistance: The use of antimicrobials in animal agriculture is considered a major contributor to the emergence and spread of antimicrobial resistance in the environment. The concern over antimicrobial resistance has important consequences for public health and food-animal industries, including restricted access to global markets. The goal is to monitor prevalence, amplification, and dissemination of antimicrobial resistance genes and bacteria that carry resistance genes in beef cattle.

The four issues outlined strengthen the need to understand the ecology and epidemiology of food-borne pathogens for effective pre-harvest intervention strategies so that cattle with fewer pathogens and lower antimicrobial resistance elements are presented for slaughter. Control strategies aimed at reducing the prevalence and concentration of these bacteria and their resistance elements in cattle feces, thus reducing the overall number of bacteria entering both food and environmental pathways, may be the most effective approach for reducing the overall risk of human infection and maximizing public health outcomes.

Agency Contact Information

USDA NIFA
Director
Kansas City, MO

Healthy Food Systems for Healthy People

Background

The global food system is very complex and interconnected to human health and well-being. Food is linked to physical, emotional, social, environmental, and economic aspects of healthy living. Although there is a need to increase production to meet future food supply demands, we cannot lose sight of the importance of public and environmental health. Human and environmental health are directly impacted by food, from its production to what is on the consumer's dinner plate.

Key stakeholders have acknowledged the interconnectedness of health and the food system, and the critical need for systems-level interdisciplinary approaches to tackle challenges across the food system. The National Research Council recommended systems level approaches in 2015 through their "A Framework for Assessing Effects of the Food System" report. APLU's 2016 "Healthy Food Systems, Healthy People" initiative calls for systems approaches to uncover strategies that will result in positive health outcomes. In response to these and other calls to action, Federal and other national science agencies prioritized their funding. For fiscal year 2019, USDA will invest almost \$100M in systems level research to "support large integrative projects that develop solutions to major agricultural system challenges." The agency identified a specific need to "enhance the contribution of food and agriculture to [the] health of the nation..."

Kansas State University is uniquely positioned to address health-related challenges and seize opportunities across the food system to improve health and wellness in Kansas, the nation, and the world. Our strength in providing solutions to these complex food system challenges is due to the expertise and dedication of faculty and staff who work across nearly all of our colleges and campuses.

Description

To promote a healthy population, transformative innovations and approaches are needed across the food system, from the farm to the day-to-day choices and activities of consumers. K-State research and extension programs are working in lock step to ensure food systems are providing nutritional security and, at the same time, are sustainable given the current and future environmental and climate challenges. Additionally, K-State excels at delivering knowledgeable and well-trained individuals who positively contribute to the food system, filling critical positions in the food industry, academia, and Federal and state agencies to name a few.

K-State ensures the health and wellness of consumers through impactful food systems research and the delivery of useful information to farmers, ranchers, processors, retail food industry, and consumers themselves. K-State is making both local and global impacts across the food chain, some examples of areas where we have strengths include:

Production

- Water quality and quantity (irrigation, surface, and ground water)
- Integrated pest management
- Post-harvest handling to improve safety, sensorial, and nutritional quality factors in fresh produce

Processing

- Food safety — microbial and chemical
- Shelf-stable, convenient, nutrient dense foods
- Food packaging — novel, sustainable options, including control of postharvest disease

Retail

- Health-focused messaging
- Assistance and development of farmers' markets and vendors (food safety education)
- Regulatory compliance

Consumer

- At home food safety education and interventions to prevent foodborne illness
- Consumer acceptance of food products, including pet food
- Sensory analysis – improving acceptability of nutritious food

Workforce Development

- Food industry internships
- Cultural competence & education abroad
- Many degree options and avenues (on campus and online)

Relevance

K-State research and extension efforts are driving innovation and uncovering solutions needed for solving food system challenges. Furthermore, K-State is training the next generation of food system scientists who will continue to spur innovation and advance Kansas' and the nation's agricultural competitiveness.

Agency Contact Information

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Conserving the Ogallala Aquifer

Background

Groundwater from the Ogallala Aquifer is used extensively to produce food and drive the economy of western Kansas. This region leads Kansas in crop production and comprises the core of the U.S. beef cattle feeding industry. The top eight Kansas agricultural counties are located over the Ogallala Aquifer and represent one-third of Kansas' total value of agricultural production. However, water is increasingly in short supply in the Ogallala region of western Kansas. Kansas State University research in 2013 estimated that, in the Kansas portion of the aquifer, 30% of the water was already depleted; by 2060, 70% would be depleted; and, by 2100, almost all would be completely depleted. It is common today to have well yields of 1/4 to 1/3 of historic well yields. In Kansas Groundwater Management District #1 in west central Kansas, useful lifetime of the aquifer is estimated at 10 to 30 years.

The rapid depletion of the Ogallala Aquifer has been recognized by both state and local governmental organizations, groundwater management districts, and local citizens. In Kansas, significant regulatory and legislative changes have occurred in recent years in an attempt to extend the life of the Ogallala Aquifer. For example, Kansas enacted legislation that allows local groups of farmers to voluntarily develop their own "local enhanced management areas (LEMAs)." The first LEMA developed in northwest Kansas required all irrigators to reduce their water withdrawals by 25% over a 5-year period. Kansas has also enacted a 5-year flex program where irrigators can enroll and then are able to use their water over a 5-year period, which allows more flexibility and the possibly reduce their overall water use. In 2014 and 2015, Kansas developed a 50-year vision for water. This plan identified research and management needs, as well as suggested needed updates in legislation.

Description

The 50-year vision for water in Kansas calls for a significant investment in research and technology development efforts led by K-State, combined with rapid technology transfer to the agricultural industry. As demand for water resources continues, improved water management practices for crop and livestock production will be critical for sustaining economic viability and population base of the region. The latest tools and technologies must be developed and adopted by water users.

The 50-year vision document identified four major areas that K-State is essential: 1) identifying and developing new drought resistant crops and varieties/germplasm; 2) new irrigation technologies; 3) extension programs to enhance adoption of new technologies; and 4) new education curriculum and delivery to university students and the general public on water issues.

As a land-grant university, K-State has water-related expertise in:

Research: Plant genetics and crop varietal development, crop and animal production, irrigation and water management technologies, and economics.

Education: Curriculum in engineering, water management, plant genetics, economics, and computational models to train the next generation of water scientists and managers.

Extension and Outreach: Engagement with agencies and stakeholder organizations to identify alternative methods and policies for managing groundwater and agricultural management challenges and assisting farmers and other water managers in implementing new practices.

Relevance

The K-State team:

- 1) Informs citizens, planning agencies, and policy makers and helps them understand technical aspects of water resource management and the production, economic, and social impacts of policy strategies.
- 2) Develops more drought-tolerant crop varieties, efficient irrigation technologies, and water and nutrient management.
- 3) Evaluates alternative food and feed grains, oil seeds, and energy crops for drought- and heat-tolerance, adaptation to no-tillage or strip-tillage production systems, and utility as feed for livestock or feedstock for liquid fuel production.
- 4) Utilizes the latest technologies and computational forecasting tools to quantify and understand interactions and feedbacks between available water resources and societal needs and values.

Kansas seeks long-term solutions to manage a depleting Ogallala Aquifer and to develop agricultural systems, engineering, and policy solutions that will sustain the aquifer for current and future generations.

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Urban Food Systems Institute

Background

Food security. We have created a need for resilient food systems capable of adapting to changes due to a growing population, global politics, climate change, dwindling natural resources, market changes and poor diet preferences among consumers.

Workforce development. Local food sales totaled at least \$12 billion in 2014, up from \$5 billion in 2008. Experts anticipate at least \$20 billion by 2020. More than 22 major cities, from Baltimore to Seattle, have created leadership roles for change makers focused on food. The demand for food-systems experts to address obesity and food access, particularly in urban communities, continues to grow.

New Legislation. The enacted 2018 farm bill creates new authorities specific to urban agriculture including: an Office of Urban Agriculture and Innovative Production at USDA to encourage and promote urban, indoor, and other emerging agricultural practices; an Urban Agriculture and Innovative Production Advisory Committee; USDA grant authority to support the development of urban agriculture and innovative production; pilot projects to operate in counties with a high concentration of urban or suburban farms; and USDA reporting requirements. The 2018 farm bill authorizes annual appropriations of \$25 million (FY2019-FY2023) to support these efforts.

Description

Although agriculture increasingly operates globally, it is also becoming more local. As urban centers grow, the demand for locally grown produce is driving the redevelopment of fruit and vegetable production in urban and peri-urban areas. This trend is particularly relevant for produce growers as fruits and vegetables have a relatively short storage/shipping life and have extremely high nutrient content that can benefit food security in urban communities. Clearly, there is an increasing need for researchers and professionals who are knowledgeable about urban agriculture and the associated local food systems given the expanding consumer demand for local food and the changing demographics of horticultural food crop producers. Careers are developing in this new area, known by several names such as urban agriculture, urban horticulture, and urban food systems. Now more than ever, a group of leaders is needed in the agricultural community to help successfully facilitate a revolution in the way consumers think about food.

The Department of Horticulture and Natural Resources, in the College of Agriculture at Kansas State University, identified food crops and global food systems as a target focus area of expertise as part of its 2025 Strategic Plan. The Urban Food

Systems graduate program, launched in 2011 and 2013 in Manhattan and Olathe, respectively, is a highly successful result of this initiative. The four horticulture faculty and one food science extension specialist working in UFS have collaborated well together, working across their appointment areas in teaching, research, and extension to move beyond the graduate program to establishing K-State as an emerging leader in UFS across all three mission areas. Faculty from more than 15 different disciplines across almost all K-State colleges collaborate on this program. Given this success, particularly after the first National Urban Food Systems Symposium in 2016, we were encouraged by the College of Agriculture leadership to formalize this initiative through the creation of an Institute. A five-year development plan for the Institute was submitted to Dean Minton in early September 2019.

Relevance

With operational and infrastructure investment, the Urban Food Systems Institute will secure and maintain the global leadership position on a permanent basis.

The institute's objectives reflect the land-grant mission:

1. Train the next generation of leaders and extension educators to facilitate successful and resilient urban food systems.
2. Develop and disseminate urban agriculture extension programs and services that support urban agriculture.
3. Expand farm-to-fork research in technologies such as: protected production systems (greenhouses, warehouses and vertical and rooftop farming), high-intensity production, appropriate postharvest handling and sustainable and regenerative farming practices.
4. Develop farmers and farms for the urban food system through trainings, workshops, and farm demonstration;
5. Expand and coordinate engagement of K-State faculty and staff in interdisciplinary urban food systems applied research, education, and outreach.

The Urban Food Systems Institute will provide a venue for collaborative, multi-disciplinary, interdisciplinary, and trans-disciplinary work among graduate students, researchers, practitioners, and industry partners.

Agency Contact Information

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USDA NIFA
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Transboundary and Emerging Infectious Diseases of Food Animals

Background

The United States is fortunate to have a food animal production system that is free of most devastating diseases that are endemic in other parts of the world. This allows abundant, diverse and relatively inexpensive production of animal protein for both domestic consumption and a large export market. However, this industry, and by extension public health and well-being, are vulnerable to accidental or intentional introduction of transboundary animal diseases (TADs) and the potential catastrophic economic and social results. As African swine fever virus (ASFV) and Classical swine fever virus (CSFV) continues to spread across Southeast Asia and the globe, and new strains of Foot and Mouth Disease virus (FMDV) continue to emerge, there is increased concern that TADs may enter the United States. Many microbial organisms found in animals (whether disease-causing in animals or not) can cause serious diseases in humans (so-called zoonotic agents). Examples include among others: rabies, SARS, *Salmonella*, *E. coli* O157, *Brucella sp.*, *Mycobacterium sp.*, avian/swine Flu, RVF virus, Ebola/Marburg viruses, anthrax, BSE, Henipaviruses and MERS.

It is critical, therefore, that the U.S. maintains and continually improves vigorous monitoring, control plans and capabilities for rapid and accurate detection and control/elimination of transboundary, zoonotic and emerging animal diseases.

Description

Research and education efforts in the Department of Diagnostic Medicine/Pathobiology (DMP) at KSU cover a multitude of potential threats and are directed at developing and improving upon transboundary, zoonotic and emerging disease detection and control countermeasures. Most projects are collaborative in nature, utilizing teams of researchers at various universities; state and federal government agencies, both domestic and international; and private industry. Researchers at KSU maintain strong ties with the USDA, including ABADRU, FADDL and PIADC, and DHS as well as with livestock producers and field veterinarians.

Research aimed at understanding viral pathogenesis and developing safe and effective vaccines and diagnostics are underway for diseases of major concern to food animal health, such as ASF, RVF, CSF, FMD, PRRS, swine influenza, Seneca Valley, PED and HPAI. Active research of these agents and on arboviruses and their mosquito vectors is conducted in DMP and the Biosecurity Research Institute (BRI) at KSU. State-of-the-art techniques and instrumentation include point of need (PON) and multiplex molecular detection methods and next-generation sequencing to enhance our ability to rapidly

identify specific pathogens in an outbreak situation or provide general biosurveillance tools by utilizing both laboratory and PON testing. College of Veterinary Medicine faculty researchers are using risk assessment, spatial analysis and surveillance methodologies to study the epidemiology of ASF, FMD and other TADs in order to aid potential outbreak prediction and control. Several projects are devoted to educating veterinarians and other first-responders to recognize, respond to, and aid recovery from TADs and to train the next generation of veterinary researchers in specialized work requirements.

Capabilities include the training and expertise necessary to safely and securely conduct research in BSL-2 and BSL-3Ag environments of the Large Animal Research Center (LARC) and BRI, respectively. Researchers are knowledgeable about the compliance requirements associated with Select Agent work. Other ongoing efforts include initiating activities to transition PIADC and FADDL functions into the new National Bio and Agro-defense Facility (NBAF) under construction in Manhattan, KS.

Relevance

Research conducted in the DMP department is specifically directed at protecting U.S. food-animal agriculture, especially the pork, cattle, sheep and poultry industries, from potentially devastating infectious diseases. PRRS is one of the most important infectious disease problems in pigs and costs the US swine industry up to \$600 million in losses each year. Other recent examples of the major economic impact of infectious diseases of food animals in the U.S. include porcine epidemic diarrhea (PED) in 2013/14 and the devastating highly pathogenic avian influenza (HPAI) outbreak in 2015; the latter outbreak was estimated to have cost the poultry/turkey industries approximately \$4 billion. Countermeasures for other TADs of major concern to the U.S. Department of Homeland Security and USDA, due to their significant potential to cause outbreaks in the U.S. with serious industry and economic ramifications, are currently studied at KSU and with external collaborators. As ASF virus continues to march across the globe, KSU researchers work diligently with the U.S. pork industry as well as state and federal entities, to develop countermeasures (vaccines, diagnostics, risk assessments, etc.) on keeping it from reaching the homeland.

Agency Contact Information

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Preparing the Bio/Agrodefense Workforce

Background

Protecting American agriculture – crops, livestock, and food from global biothreats, while safeguarding people from zoonotic animal diseases and foodborne pathogens, is vital to U.S. homeland security as called out in the 2004 Homeland Security Presidential Directive-9 (HSPD-9). The 2018 National Biodefense Strategy reiterates this crucial mission.

Kansas State University (K-State) stands ready to deliver tailored education and training programs to prepare and maintain the bio/agrodefense workforce needed for our Nation's biodefense strategy, specifically for USDA and the National Bio and Agro-defense Facility (NBAF) under construction in Manhattan, KS.

Description

Based on the needs assessment developed during the pre-NBAF OPTIC process led by the Department of Homeland Security (DHS), expectations for the management and operations of NBAF focused on the necessity for training programs for NBAF employees. Specifically, NBAF needs fully-trained, competent staff capable of conducting research with Select Agents (SAs) and working within BSL-2 through BSL-4 laboratory settings with large livestock models.

The K-State Biosecurity Research Institute (BRI) is one of fewer than six high containment facilities in the U.S. that can conduct research on livestock experimentally infected with a broad range of highly pathogenic organisms. The BRI is the designated facility at K-State for work on organisms classified as SAs, and has been a partner with the Plum Island Animal Disease Center in the transition of science to NBAF. BRI faculty and staff have developed world-renowned hands-on training for students and staff at all levels for operating in and managing very specialized facilities. These programs have trained and approved personnel to ensure accountability, safety, and security.

The BRI has over 10,000 square feet dedicated to education, including a tiered classroom seating 25 people that adjoins a fully-equipped biocontainment training laboratory. The lab provides hands-on training activities in a pathogen-free area. Students gain foundational skills in a realistic work environment without the risk of biosafety concerns or biocontainment breaches. The training suite also includes world-class high-definition video capture and streaming technology allowing the training and research areas to serve as filming studios for online distance-education courses.

To date, almost 430 individuals have received training to work in containment at the BRI. Based on the anticipated workforce needs for NBAF, many agencies have invested in training

programs at the BRI including DHS, USDA-APHIS, and the State of Kansas. Since 2016, DHS has supported seventeen students to train for research in high containment and APHIS has committed to support six KSU students (M.S., Ph.D., or D.V.M) with guaranteed employment at NBAF. A new APHIS sponsored program will support training of 20 undergraduates in high containment diagnostics.



With investments from USDA, the BRI will be able to expand current capacities in education and training to deliver a comprehensive program to meet future needs. Specifically, APHIS requires Foreign Animal Disease (FAD)-related technical education along with training and proficiency testing associated with the National Animal Health Laboratory Network. ARS recognizes that the partnership between the Arthropod-Borne Disease Laboratory and the BRI will continue to provide trained personnel to address emerging zoonotic diseases. NBAF success will require training with a focus on relevant pathogens, experience working at various biocontainment levels, and use of both agricultural and wildlife animal species.

Relevance

The proposed training program is in keeping with the five goals articulated in the 2018 National Biodefense Strategy for strengthening the biodefense enterprise, including to “Strengthen biosafety and biosecurity practices and oversight to mitigate the risk of bioincidents” and “Ensure a vibrant and innovative national science and technology base to support biodefense”.

Agency Contact Information

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Global Food Systems Initiative

Background

The United Nations Food and Agriculture Organization estimates that one in eight people worldwide are hungry. Yet at the same time, the obesity rate in developed countries is over 30% and that rate is increasing in developing countries. Food security as defined by the World Health Organization is the “availability and adequate access at all times to sufficient, safe, nutritious food to maintain a healthy and active life.”

Food production, packaging, and transportation is a mainstay of the Kansas economy, comprising a \$40 billion industry that provides food to Kansans and the greater national food requirements. Despite the abundance of food production in the U.S., hunger remains a challenge here.

The Global Food System is immensely complex and addressing current and impending challenges in food security will require novel, varied, and interdisciplinary research approaches.

Description

As a land-grant university, a great deal of Kansas State’s research focus is on food and food systems. Food research global strengths include applied research in crops – wheat, sorghum, and millet, and animals – cattle, swine, goats, and sheep, at the production, processing, distribution, and protection levels. Additionally, on the consumer side, our research strengths include nutrition, sensory analysis, and consumer based food safety.

Basic science research supports applied work through studies in physics, chemistry, biochemistry, chemical engineering, and biology, which provide the basis to develop a clearer understanding of global food systems and to create fundamentally new technologies and methods to help advance solutions. Some specific areas of focus include: microbiological research on developing an interface that captures bacterial pathogens to aid rapid culture free detection methods; development of fundamentally new methods of measuring and managing crop quality; genetics – both genetic mapping and genetic modification used in improving performance of crops; and research on insect molecular composition and how it affects product loss. All of these areas of research are supported through both fundamental and applied scientific research and provide knowledge that can be advanced to practical users such as producers.

Engineering research plays an important role in global food systems, encompassing areas such as computer controls, supply chain design, infrastructure issues, and mechanical and building design.

The nexus of food, water and energy is another area requiring interdisciplinary approaches that include agronomists, geographers, geologists, civil engineers, and landscape architects to understand and develop sustainable solutions. This work both illuminates the challenges we currently face and anticipates future ones resulting from climate change and population growth.

It is clear that not all solutions to problems facing the complex global food system are technology-based. Understanding political climates, social, economic, and moral challenges, and the ability to communicate clearly become barriers to food availability and sustainability. K-State’s humanities and social sciences researchers, particularly those with an international focus and critical to our efforts. Moreover, a recent Economic Development Agency i6 grant funds our GFS Accelerator, connecting our Center for Entrepreneurship, our Research Foundation, and our innovations to developing small businesses.

A recently awarded NSF grant provides a look into the future of interdisciplinary learning and research. Dr. Melanie Derby, assistant professor of mechanical and nuclear engineering is leading a team of researchers in food-energy-water system in rural agricultural areas. That team of scientists, sociologists, engineers, economists and educators will tackle the challenge of innovating solutions designed to protect rural communities.

Relevance

Because of our land-grant mission, local, regional, national, and international expertise and connections, K-State has the ability to help identify and tackle future demands of the complex global food system.

Questions raised in the sustainability of feeding the growing population under increasingly strained environmental conditions cannot be addressed in a singular approach. K-State has the tools needed to form truly interdisciplinary research approaches to solving these problems.

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Population Health: Center for Outcomes Research and Epidemiology (CORE)

Background

The health and productivity of the U.S. agriculture and food system are vital to the national economy and security. Any disruption of this critical infrastructure, such as from emerging, transboundary, and/or zoonotic disease incursions or changes in endemic disease status, would have devastating impacts on both animal and public health. To prepare for and respond to these risks, the detection, distribution, and determinants of disease (i.e., epidemiology) must be understood by all stakeholders across the spectrum of the agriculture enterprise. Maintaining the health status of animal and human populations requires knowledge of detection, distribution, and determinants before informed decisions can be made with confidence. As such, federal and state health officials (both human and animal health), veterinary practitioners, livestock producers and allied industry leaders require high quality information, data analyses, and advice on population health risks.

Description

The ability to address these needs and protect and improve animal and public health requires the expertise and integration of epidemiology, surveillance, economics, veterinary medicine and other disciplines, with understanding and application at local, state, regional, and national levels. With its Center for Outcomes Research and Epidemiology (CORE), in conjunction with other Centers and Institutes, networks of collaborating experts within and outside K-State, and close partnerships with the agriculture industries and state and federal governments, the College of Veterinary Medicine at Kansas State University brings the necessary expertise under one umbrella. In fact, it may be argued that K-State is a leading university for epidemiological research, service and training in the U.S., as no other institution has its number or breadth of experts within this field. K-State interdisciplinary teams provide: 1) **outcomes research and evidence-based advice** to stakeholders, such as through intervention effectiveness studies, disease modeling, risk assessment, and pre-harvest strategies to promote food safety and security and address antimicrobial resistance; 2) **enhanced surveillance** by developing novel and practical methods, technology and tools, and incentivizing their use, to enhance on-farm data collection and early disease detection, with supporting data integration, analysis and dissemination of information tailored to the end-user to support decision-making; 3) **diagnostic approaches**, including cutting-edge technologies to detect the unknown and rapidly identify the known pathogens, and sharing of critical disease emergence

information to 'network' laboratories and state/national agencies; 4) **innovative thinking and horizon scanning** to support policy and program development, and prepare for effects of land use or climate change, emerging technology, trade dynamics, and other factors on the future of livestock production, public health and global food security, as well as resulting implications for disease prevention and control; and 5) **outreach and training** to prepare first responders and animal health officials on disease preparedness and response, while also building these capacities to recruit and develop the next-generation veterinary workforce.

The Center for Outcomes Research and Epidemiology (CORE) at Kansas State University is a unique interdisciplinary research and training center that excels in population-based and quantitative approaches to enhance animal health for the benefit of animals and society. The current engagement and recognized leadership in significant health and economic issues at the national and global levels are relevant to societal concerns and changing needs.

Relevance

Kansas is at the center of U.S. livestock production and animal health commerce. With the Animal Health Corridor located between Manhattan, KS and Columbia, MO, and the Department of Homeland Security building its \$1.25 billion National Bio and Agro-defense Facility (NBAF) in Manhattan, KS beside the veterinary college, the K-State College of Veterinary Medicine is strategically placed at the U.S. epicenter of regional, national, and global animal health. Its leadership and expertise will be relied upon to work with veterinarians, their human health counterparts, industry, and state and federal governments to address challenges and find solutions. These sectors rely on transparent, credible data and information, and support its translation and application into practice for informed decision-making at local, regional, and national levels. K-State College of Veterinary Medicine, through the CORE, has a premier, unique interdisciplinary team to tackle these issues and serve as both a liaison and trusted source to support stakeholders in these decisions, help protect and promote our livestock industries, and ensure the prosperity of national and global population health and food security.

Agency Contact Information

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Integrated Solutions for U.S. Bio/Agrodefense: National Agricultural Biosecurity Center

Background

Protecting American agriculture and food from global biothreats, while safeguarding the public from zoonotic animal diseases and food borne pathogens, has been recognized as being vital to U.S. homeland security. The Homeland Security Presidential Directive-9 (HSPD-9), issued on Jan. 30, 2004, identifies six areas as critical for this mission. These are 1) awareness and warning; 2) vulnerability assessments; 3) mitigation strategies; 4) response planning and recovery; 5) outreach and professional development; and 6) research and development.

Subsequent law and guidance have codified the mandates of HSPD-9 (Public Law 115-43 in 2017 and National Security Presidential Memorandum-14 in 2018).

Description

Kansas State University's National Agricultural Biosecurity Center (NABC) is an important contributor to the activities specified by HSPD-9. This has been recognized by the Food, Agriculture, and Veterinary Resilience (FAVR) group at the Department of Homeland Security (DHS-CWMD), which has tasked NABC with defining today's bio/agrodefense capabilities. NABC will add expertise in the agriculture and food domains to the Intelligence Community by analyzing gaps and developing intelligence information requirements needed for awareness of risks and threats to the U.S. agricultural enterprise. Also, NABC will continue to build a national-level picture, county by county, of both vulnerabilities and capabilities of the U.S. to respond to a catastrophic incident impacting the food and agricultural sector.

NABC's resident expertise in response planning, training and exercising for high consequence disease outbreaks has been tapped by USDA to test capabilities locally, regionally and nationally. NABC will conduct an exercise in the High Plains region to test the region's capabilities to provide business continuity through intra- and interstate livestock movement permits. NABC will also conduct, on behalf of USDA, regional exercises at the state level to test local jurisdictions' abilities to execute their response plans.

NABC is expanding its mission area to include community resilience by creating a multidisciplinary program that includes the wide-ranging economic effects of high consequence animal disease outbreaks to encourage planning for business continuity and recovery. This area includes analysis of and response planning for agricultural inputs, i.e. feed ingredients and feed mills, and external activities like livestock exhibitions.

Relevance

America is unprepared for a high consequence disease outbreak targeting agriculture and/or food. Interruptions to the food supply, whether naturally occurring or manmade, destabilize public health and the economy. Unintentional disease outbreaks in recent years, including avian influenza and porcine epidemic diarrhea virus, have demonstrated this.

Greatly improved awareness and warning, vulnerability assessments, and response planning and recovery are needed. NABC is poised to play an important role in these efforts. Specifically:

1. Supporting efforts to reduce the economic and physical vulnerability of the livestock and food systems supply chain by emphasizing the National Livestock Readiness Program and analysis of permit networks.
2. Assessing readiness and developing capability of state and local jurisdictions to effectively respond to biological incidents, with an emphasis on response training and exercise activities.
3. Promoting the collaborative efforts of the agricultural enterprise to prepare for and respond to current and future disease threats, with an emphasis on NIFA tactical sciences network.

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Research & Development for U.S. Bio/Agrodefense: Protecting Agriculture and Preserving Public Health

Background

There is increasing awareness of the risks posed to U.S. agriculture and public health due to processes such as 1) the accidental or deliberate introduction of disease agents previously confined to other parts of the world, 2) the emergence of hitherto unknown pathogens or 3) the acquisition of new capabilities by microbes previously considered benign.

The 2018 White House National Biodefense Strategy outlines five goals with associated objectives for strengthening the biodefense enterprise, including to “Strengthen biosafety and biosecurity practices and oversight to mitigate risks of bioincidents” and to “Ensure a vibrant and innovative national science and technology base to support biodefense.”

Description

The Kansas State University Biosecurity Research Institute (BRI) at Pat Roberts Hall is a linchpin of U.S. bio/agrodefense capabilities because of its capacity to support research and development of diagnostic tools, contribute to greater understanding of the basic biology and life cycle of poorly-understood pathogens, and provide a testing ground for possible countermeasures and treatments.

The BRI is one of a few high containment facilities in the U.S. allowing research on livestock experimentally infected with a broad range of highly pathogenic organisms. For example, the BRI is the designated facility at KSU for work on organisms classified by the U.S. government as Select Agents. These are agents that have the potential to be weaponized and require specialized facilities and highly trained personnel to ensure constant safety and security. Research at the BRI has already resulted in development and testing of two vaccines for highly pathogenic influenza, a vaccine for classical swine fever, and vaccines for Rift Valley Fever virus. These diseases are either zoonotic or potentially devastating to agriculture, or both.

Among the specialized facilities at BRI are 1) a state-of-the-art Arthropod Containment Level 3 Laboratory and supporting mosquito-rearing room that allows researchers to investigate interactions between pathogens and their insect vectors and 2) a food production research suite that supports research on pathogens entering the food production process at various points. BRI has hosted research on mosquito-borne diseases such as Japanese encephalitis and Zika as well as on deadly food-borne pathogens including Shiga-toxin-producing *Escherichia coli* and potential deliberate contaminants such as *Bacillus anthracis*.

Plant pathogens are also under study at the BRI, including known and emerging pathogens that threaten Kansas and worldwide production of three of the top five crops grown globally, namely wheat, corn, and rice. Research topics include improving our ability to predict and detect the emergence of new pathogen varieties with enhanced virulence as well as mitigation strategies for existing and novel types. One example is wheat blast, which is a newly emerged and globally spreading disease causing substantial losses in South America and Southern Asia. This disease, and others, have the potential to disrupt food security and to destabilize already weakened nations.

Relevance

America is unprepared for a bioterrorism attack targeting agriculture — crops or livestock — or food. Interruptions to the food supply, either natural or manmade, threaten public health and economies. Furthermore, a growing worldwide population, changes in land use and climate, and increased global mobility and trade all increase the likelihood of the spread of previously unknown diseases. Improvements in basic science, vulnerability assessments, and mitigation strategies are needed to address these real threats.

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College of Veterinary Medicine/Association of American Veterinary Medical Colleges

Background

Veterinary medicine is an integral and indispensable component of our public health system as well as our agriculture and agricultural biosecurity systems. In addition to their obvious role in maintaining animal health, veterinarians also protect human health by preventing and controlling infectious diseases, ensuring the safety and security of our food supply, promoting healthy environments, and providing health care for animals. There are only 32 veterinary medical colleges in the country, and they do not have enough capacity to meet all of these needs.

To be successful, programs that seek to recruit and retain veterinarians in careers in food animal practice, public health and agricultural biosecurity must compete effectively with programs recruiting veterinarians to many other career options. A new graduate from an accredited U.S. veterinary medical school or college typically enters the profession with over \$174,000 of educational debt. With such financial pressures and analyses, a career in food animal practice and agricultural biosecurity often pales in comparison to the salary potential of other, more lucrative career options. Consequently, measures to relieve a significant portion of debt, contingent upon entering and remaining in a career in food animal practice and agricultural biosecurity, are very important for the recruitment and retention of veterinarians to this area of national need.

Description

The Agriculture Act of 2014 (PL 113-79) contained provisions important to veterinary medicine. Section 7104 established a competitive veterinary services grant program to develop, implement, and sustain veterinary services. Authorized at \$10 million annually, this section would amend the National Agricultural Research, Extension and Teaching Policy Act of 1977 to direct the Secretary of Agriculture (USDA) to carry out a program with qualified entities to develop, implement and sustain veterinary services in the states. The program received initial funding in FY 2016 for \$2.5 million.

The Veterinary Medicine Loan Repayment Program (VMLRP) Enhancement Act would amend the Internal Revenue Code to make VMLRP awards exempt from gross income and employment taxes. Awards are currently taxed at 39% although those taxes are paid by USDA directly to the treasury on behalf of the award recipient. Tax exemption for VMLRP awards would result in one additional veterinarian for every three based on current appropriations.

Support is requested for: 1) Provisions of the Agriculture Act of 2014 (PL 113-79) important to the veterinary profession, namely the Animal Health and Disease Research/1433 Formula Funds; Centers of Excellence, Food Animal Residue Avoidance Databank (FARAD), and the Competitive, Special and Facilities Research Grant Act, as well as funding for the Veterinary Services Grant Program (VSGP) to develop, implement, and sustain veterinary services, 2) tax exemption for awards made under the Veterinary Medicine Loan Repayment Program (VMLRP), and 3) passage of appropriations legislation that maintains or increases funding for the VMLRP, Animal Health and Disease Research/1433 Formula Funds, Agriculture and Food Research Initiative, FARAD, the VSGP, the National Animal Health Laboratory Network (NAHLN) as well as for the National Institutes of Health (NIH).

Aspirations for the appropriations for Fiscal Year 2021 should be to maintain or increase current funding levels for such critical programs as the Animal Health and Disease Research/1433 Formula Funds, Veterinary Medicine Loan Repayment Program, Agriculture and Food Research Initiative, the Agricultural Research Service (ARS), and the National Institutes of Health.

Relevance

Agriculture, and specifically animal agriculture, is vital to the Kansas economy. Training, recruiting, and retaining enough veterinarians to meet the needs of agriculture and of agricultural biosecurity are important concerns of agriculture and related organizations. Kansas would clearly benefit by increased federal investment in the training of veterinarians in agricultural biosecurity and food animal practice, as well as in their subsequent recruitment and retention.

The proposed federal investment would augment, not replace or diminish the importance of funding from the state of Kansas. It will, however, multiply the impact of state funds and enhance the ability of Kansas State University and the College of Veterinary Medicine to meet the needs of the state and nation. Leaders from the Kansas Congressional delegation have lent their support to these important legislative efforts.

Agency Contact Information

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EPICENTER: Laboratory for a Network Science Approach to Predict and Control the Spread of Infectious Diseases; within the Network Science and Engineering (NetSE) group

Background

Few events disrupt society and cause economic loss as severely as an out-of-control infectious disease. Terrorist activities or natural causes can produce an epidemic that may result in human deaths, disposal of herds, and destruction of crops. Fundamental to EPICENTER's mission is the conviction that epidemic dynamics and intervention strategies must be derived, while accounting for underlying complex networks that describe multiple and dynamic interconnections among involved systems.

Description

EPICENTER, a laboratory within Kansas State University's Carl R. Ice College of Engineering, provides resources to build, analyze, and simulate data-driven computational models for biomedical and biological systems represented as complex networks. Research at EPICENTER challenges scientific boundaries by addressing the impact of heterogeneity, interdependence, and stratification of networks in spreading processes. These three characteristics abound in natural and manmade infrastructures and networks, but fundamental questions remain unanswered regarding interconnected and stratified/multilayer networks.

EPICENTER has successfully conducted several research projects since its inception in 2007. Current projects include the following:

- *Predictive models of infectious diseases.* This project aims to develop innovative, multiscale computational models and tools to describe potential transmission cycles of zoonotic pathogens that could be introduced into the United States. Data generated by these models will be used to produce an operationally relevant predictive model that estimates the timing and spatial extent of emerging disease, and the transmission risk to humans. Studied diseases include Ebola, Rift Valley fever, and Japanese encephalitis.
- *Spreading processes over multilayer and interconnected networks.* The research goal of this project is to establish mathematical tools and techniques to understand the role of multilayer and interconnected topologies in spreading processes. For example, a multilayer network is a physical contact network in which a disease can propagate among individuals and an online information-dissemination network in which information can propagate among those same individuals. In zoonotic diseases, interconnected networks include the network of animals and the network of humans in which a virus can transfer from one population (network) to another.

- *Integrated models of disease spread, supply chain logistics, and communication networks.* The objective of this project is to develop integrated models that capture interdependencies among disease dynamics, supply chain logistics, and communication networks. For example, the spread of disease is influenced by the movement of animals, plants, and food products through the supply chain. Effective management of this movement and deployment of countermeasures, such as vaccines, require effective risk and crisis communication plans that engage multiple stakeholders. Stakeholders also constitute a network through which information is transmitted. The integrated modeling approach is expected to yield new insight to prevent, mitigate, and respond to infectious disease outbreaks.

Relevance

The National Agricultural Biosecurity Center (NABC), Institute for Computational Comparative Medicine (ICCM), Center of Excellence for Emerging and Zoonotic Animal Diseases (DHS CEEZAD), the planned National Bio and Agro-Defense Facility (DHS NBAF), and EPICENTER are all located in Manhattan, Kansas, thus making Kansas the national leader in developing countermeasures to naturally occurring and intentionally introduced plant, animal, human, and zoonotic diseases.

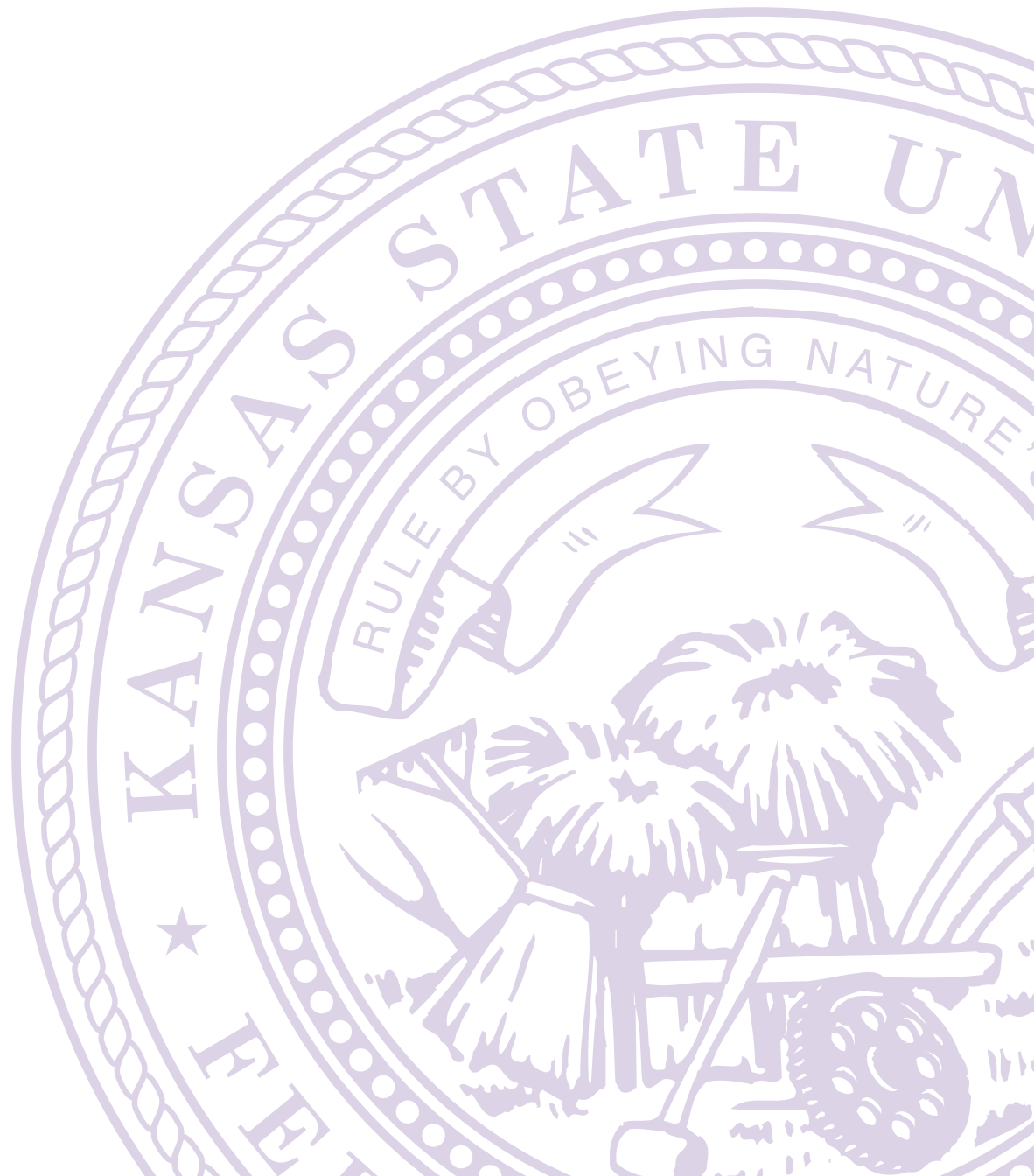
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COMMERCE, JUSTICE, SCIENCE



Konza Prairie Biological Station: A World-Class Platform for Research on Ecology, Environmental Change, and Sustainability of Rangeland Resources

Background

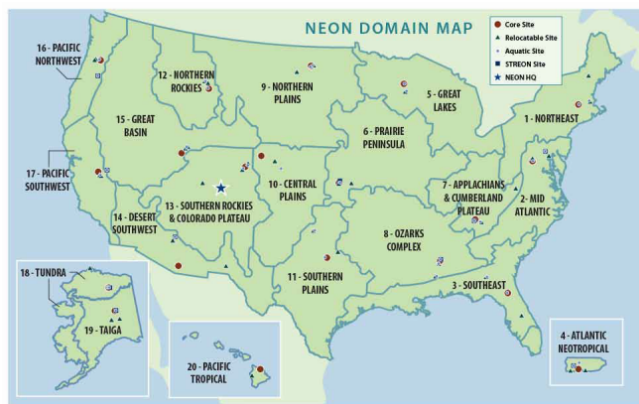
K-State's Konza Prairie Biological Station (KPBS) is a world-class research station dedicated to the research needed to most effectively and sustainably manage US grassland and rangeland resources in a changing world. KPBS is an 8,600-acre tallgrass prairie research site, jointly owned by Kansas State University and The Nature Conservancy and managed by K-State's Division of Biology. Established in 1972, it has the longest records of continuous ecological research and data collection of any grassland site in the world. It is the core site for two major National Science Foundation (NSF) programs, and a platform for research funded by numerous other state and federal agencies.



Description

The Long-Term Ecological Research (LTER) program was created by NSF in 1980 to support a network of research sites that conduct long-term research to address critical questions that cannot be answered with short-term studies. NSF funds six-year grants that are peer-reviewed and renewed based on the quality of science, research productivity and contributions to outreach and education. KPBS is the core research site for the Konza Prairie LTER (KNZ) program. Konza Prairie was one of six initial LTER sites funded in 1980, and was renewed in 2014 for the next six years at a level of \$6.76 million, bringing total LTER funding for KPBS to \$30 million.

The National Ecological Observatory Network (NEON) is a new continental-scale ecological observatory funded by NSF to gather and synthesize data on the state of the nation's natural resources and biodiversity. It consists of state-of-the-art environmental sensors and standardized research equipment and sampling protocols at a network of sites distributed across the US strategically selected to represent different ecosystem types, land-uses, and climates. For the Central US region, the core NEON sites are located at K-State's Konza Prairie Biological Station. NEON aims to transform ecological research by enabling studies of major environmental challenges at regional to continental scales, and by training a new generation of ecologists and environmental scientists to work with this regional-to-continental scale data. The Kansas sites are the only NEON sites in the multistate Prairie Peninsula region, and are expected to function for 30 years.



Relevance

The investment in facilities, infrastructure, and datasets at the Konza Prairie Biological Station makes the site uniquely poised to compete for additional federal and state funded research programs. Recent funding has included multiple grants from the NSF, USDA, and DOE. The site is also uniquely poised to become a participant in the NSF Critical Zone Observatory Network as that program continues to develop and expand.

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Bulk Solids Innovation Center

Background

The Kansas State University Bulk Solids Innovation Center provides innovative solutions in bulk solids storage, flow, conveying, and handling. Bulk solids make up more than 80 percent of items transported around the world, yet formal education is limited and the science concerning these materials is not completely understood. How solid materials behave in transport and processing requires more examination. From research, education, training, access to technology, and bench to full-scale testing of dry bulk solids, this unique Center identifies and solves real-world industrial problems.

Description

The Center is the only one of its kind in North America. It is a collaborative partnership of government, for-profit, and non-profit entities, including KSU Polytechnic Campus; the City of Salina, Kansas; the Salina Chamber of Commerce; Coperion K-Tron; Vortex Global Corporation; and several additional contributors. K-State is the key tenant in the Center, while two local companies, Coperion K-Tron, and Vortex supplement the facility by serving as anchor occupants. Our partnership brings a wealth of knowledge, experience, and expertise - in giving access to technology with a deeper understanding of customer needs and expectations.

Kansas State University Bulk Solids Innovation Center is used to study and develop the understanding of bulk solids materials handling, in turn enhancing the businesses that use these materials or manufacture the systems that convey, store and dispense them.

Relevance

Bulk solid processes are critical in many industries:

- Food
- Pet Food and Animal Feed
- Plastics
- Chemicals
- Agriculture
- Minerals
- Pharmaceuticals

The Center's research improves industrial processes:

- Material handling reliability
- Safety, Dust, and Personnel Hazards
- Energy consumption during conveying and processing
- Material flow issues that interrupt processing
- Particle damage while conveying

The Center provides **Education** to industrial personnel through short courses and college coursework that is not available elsewhere. Hundreds of industry engineers and operators, from 48 states and 6 countries, have recently attended courses at the BSIC.

The Center provides **Testing and Consulting Services** for industry, ranging from small scale sample material characterization to full-scale material handling and storage. These services help industry understand characteristics of their materials and how it affects their processes.

Bulk Solids Processing Systems

- Conveying of all types
- Storage
- Feeding, weighing, scaling
- Silo blending and segregation
- Particulate air filtration
- Gravity flow and flow aids
- Material properties testing
- Computer modeling of bulk solids handling

Future

The BSIC's goal is to lead global understanding and improvement of bulk solids handling technology. Good progress is being made, but several capital improvements are needed such as paving the parking lot and acquiring laboratory equipment such as laser diffraction particle size analyzer, FT4 rheometer, temperature and relative humidity chamber, dynamic sorption analyzer, sampling equipment, Schulze ring shear tester, instrumentation for material flow, temperature, and humidity.



Agency Contact Information

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Cultural Digital Transformation

Background

The Department of Computer Science performs world class research in several core areas, including artificial intelligence and data science, cybersecurity, high performance computing, and computer science education and outreach. Each will be discussed below.

Center for Artificial Intelligence & Data Science (CAIDS).

CAIDS focuses on managing and analyzing the massive amounts of data being collected today to fuel future intelligent systems and smart applications. State-of-the-art CAIDS research creates algorithms for data analysis, integration, reuse, and management.

CAIDS is a recognized leader in applied artificial intelligence, machine learning, and knowledge management. This expertise has been applied to knowledge representation and reasoning, data intensive problems in recommender systems, text analytics, security informatics, and bioinformatics as well as data modeling, integration and management, neural-symbolic integration. CAIDS has also made data-driven discoveries in diverse fields such as astronomy, biology, medicine, art, music, psychology, and marine biology.

CAIDS researchers provide foundational expertise that can serve a wide variety of fields with its application-oriented research and development. CAIDS has collaborated in many research areas, including recent collaborations in agriculture, astronomy, physics, engineering, psychology and biology.

Institute for Computational Research (ICR). CAIDS, along with several other KSU researchers rely on Beocat, Kansas State University's high-performance computing facility, which is run by ICR and is available to educational researchers across Kansas without cost.

ICR affiliated researchers design big data studies; adapt algorithms for parallel computing, collection, storage, and retrieval of big data; model and analyze such data; and interpret the results. ICR also provides a unique platform to train students and faculty. ICR staff and students deploy computing clusters and learn about high-performance computing and storage by contributing to ongoing research projects

The ICR has consistently developed and provided cyber-infrastructure for research and education. With existing collaborations between leading national and international research organizations (e.g., XSEDE), ICR has the potential to support cutting edge cyber-enabled and informatics research in and beyond the university.

Center for Information & Systems Assurance (CISA).

CISA has been designated a *National Center of Academic Excellence for Research in Cyber Security (CAE-R)* since 2010 by the National Security Agency (NSA) and Department of Homeland Security (DHS). CISA performs research in safety, security, security education, and secure mission-critical monitoring and control systems.

CISA supports a broad, cutting-edge cybersecurity program, including network security, cyber-physical safety and security, hardware-based security, and probability- and information-theoretic security. CISA researchers develop tools to quickly design and assemble large software systems at low cost, which are vital to the integration of dozens of software components to build complex distributed systems.

CISA has a world-class track record of building secure protocols and software systems through existing collaborations with cybersecurity industry leaders.

Computational Core (CC) Initiative. The CC was launched in 2018 to develop bold new approaches to attack the lack of trained computer professionals in Kansas and across the nation. The CC seeks to expand the available workforce by offering state-of-the-art educational opportunities to diverse groups of people.

The CC is a set of courses designed to teach non-computer science majors the core computer science concepts and skills. Courses are delivered online, are application oriented and have a low math barrier. The courses provide a foundational computer science education from middle school through college and beyond. The CC will form the core of a variety of education and training programs across the state.

The CC is a wide-ranging initiative to educate and equip all segments of Kansans population with the computational thinking skills they need to be creators in the digital economy, not just consumers, and to be active citizens in our technology-driven world.

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Science Communication Initiative

Background

Importance of science communication has been receiving much attention in the recent past. In early June of 2016, an editorial in *InsideHigherEd.com* called on universities to improve communication about the science and research being done on their campuses (Hulcr, 2016). The article offered an opinion on the importance of such communication and suggested tangible ways of approaching the task. The author noted, "There are enormous benefits to be reaped, financial as well as political, if higher education manages to enter mass media." Higher education has used mass media for a long time, but scientists are often not prepared to provide the right information for non-expert audiences or to engage with media directly. One path to improve communication between scientists and citizens is for universities to provide better training and collaboration opportunities for both scientists and communicators.

Description

The Science Communication Initiative, or SCI, seeks to engage communities in understanding, enthusiastically promoting, and actively participating in science and research. SCI aims to act as a clearinghouse for science and research communication activities on campus and connect campus entities with community partners. Many campus units and local organizations are already engaged in science and research communication activities, so our aim is to organize collaborative efforts and give all interested parties access to the same resources.

SCI formed in spring 2017 out of effort to coordinate science communication events and training sessions across campus and regional communities. In early summer 2017, the Science Communication Fellows program, a joint effort between K-State and community partner Sunset Zoo, was noticed by Maddie Sofia, producer for National Public Radio science correspondent Joe Palca. SCI recognized an opportunity to invite high-profile speakers to campus and structure activities around their visit, organizing the first Science Communication Week in November 2017, followed by the second Science Communication Week in November 2018, which were both hugely successful. Third and the most recent SCI was held from Oct 12-19, 2019 with various events throughout the week. The Flint Hills Discovery Center also partnered with SCI, and many campus units — including the Office of the President, the Office of the Senior Vice President and Provost, the Office of the Vice President for Research, and the Graduate School — helped defray costs for the week's events.

Each week included events designed for the general public as well as events for K-State students and faculty. More than 1,000 people attended the activities related to SCI each year. Future plans include an emphasis on offering continued training for graduate students, particularly in Science, Technology, Engineering and Mathematics (STEM) disciplines that typically do not offer communication training; connecting researchers with resources necessary to develop broader impacts plans and communications campaigns as part of grant proposals; reaching out to more partner organizations around the state; and providing more venues in which scientists can directly engage with public audiences.

Relevance

Researchers at K-State and elsewhere recognize a great need for communicating about their discoveries to audiences on a much larger scale than has been done in the past. In some cases, this will satisfy requirements from granting agencies, but other benefits include aiding legislators in understanding the economic value of K-State research efforts; advancements that develop new materials and health and technology advances benefiting the entire population; increasing public understanding of research and scientific issues leading to a more educated workforce; and inspiring tomorrow's researchers.

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GEOSMART: Space as the Framework for Advancing Discovery and Developing the 21st Century Workforce

Background

Geographic Information Science and Technology (GIS&T) plays an integral role in 21st century workforce development, fostering innovative and translational research, and communicating knowledge to the public. A “spatial” revolution in the land grant mission is needed to help tomorrow’s leaders solve problems in a rapidly changing, interconnected, data-rich, and science-driven world.

Description

The Department of Geography and Geospatial Sciences is developing an integrated learning and research environment — **GEOSMART** — as a physical home for geographically-informed research advances and novel outreach and community engagement tools. It brings attention to, and creates advanced capabilities for, pioneering research challenges such as the National Science Foundation’s “Big Ideas”:

- **Growing Convergence Research** – using space, and time as common ground for merging ideas, data, and approaches from diverse fields to stimulate discovery and innovation.
- **Harnessing the Data Revolution** – ensuring spatial data play a key role in large-scale research data infrastructures of the future and that the 21st century workforce is both data-capable and spatially literate.
- **NSF Includes** – developing new educational initiatives that broaden the definition for, and participation in, science and engineering fields.

GEOSMART translates these national priorities locally to enhance existing university research strengths while cultivating new expertise and capabilities:

- **The Cyber Land Grant University** –promoting convergent research by making “big” spatial data, artificial intelligence, and geospatial technologies a foundation of our future student training, knowledge discovery, and community outreach missions.
- **Global Food, Health, and Biosecurity** – exploiting spatiotemporal data about the Earth’s biophysical and climate systems to increase crop resilience and produce more food with fewer chemical inputs.
- **Decoding Nature** – monitoring the Earth system to better understand the past, improve continuous monitoring of the present, and accurately project future conditions.

Relevance

The following research themes illustrate the range of creative efforts that depend upon the nexus of physical infrastructure, human capital, and geospatial tools and technologies embodied by GEOSMART:

- **Environmental Monitoring with Remote Sensing and Big Data Analytics** – combining spectral data recorded by ground, aircraft, and satellite-borne sensors with artificial intelligence methods to detect, analyze, and map environmental resources and hazards including the physical abundance of water in global lakes and reservoirs, ecosystem services provided by grasslands, and detection of invasive species.
- **Natural Hazards and Community Engagement** – creating a public process to address the physical and social vulnerabilities of residents, business owners, and public infrastructure to flooding with the goal of building a foundation to help create communities that are sustainable and resilient. Key to this process is open sharing of data and research results.
- **Coupled Natural and Human Systems Analysis** – employing spatially informed quantitative and qualitative data analyses to untangle the complex interactions between human and natural systems to develop effective sustainable development policies.
- **Education and Workforce Development** – GEOSMART will house a new one-of-a-kind interdisciplinary undergraduate degree in GIS&T at KSU that prepares students for careers in modern spatial data analytics and information management. This new degree will attract more students into a STEM field and help address critical future workforce and research needs. A future goal for this program is to earn accreditation through the U.S. Geospatial Intelligence Foundation (USGIF).

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Robustness of Networked Infrastructures with Application to the Beef Cattle Industry

Background

Our project aims at modeling and understanding the behavior of the interdependent beef production and transportation systems under different scenarios of interest.

We have developed an agent-based model (ABM) that simulates the beef cattle industry and the transportation industry as two independent but interconnected industries. The model, built in AnyLogic, generates realistic cattle and truck movement data among premises based on regular business operating principles and assumed conditions. The data is fine-grained in both time and space, capturing each cattle and truck movement with a labeled ID.

Using this ABM, we can evaluate the system robustness by constructing hypothetical disruptions in the cattle industry and the transportation industry. Specific disruptions up to now have included the loss of cattle supply due to disease outbreaks, and the shortage of vehicles caused by deliberate attacks. The results show that the interconnected system is relatively robust against random failures, but it is vulnerable to the targeted shutdown of cattle premises or truck premises. We have also adapted and employed the ABM to study the transmission impact of a highly contagious disease, the foot-and-mouth disease.

The current cattle industry does not yet take advantage of information sharing among premises. Such information can enable coordination among premises, which helps enhance interdependent system resilience during disasters. We plan to assess the benefits of information sharing for improving the robustness of the system.

Description

Our project includes three main research tasks:

1. We study realistic cattle and truck movement systems and evaluate their robustness. The cattle production system is interconnected with the transportation system, as animals and feed need to be moved throughout production phases. Although this interdependence enables the economic functioning of the system, it also brings vulnerabilities, disease spreading potential, and natural disaster implications.
2. We evaluate the addition of an associated information sharing cyberinfrastructure and its future impact on system resilience. We propose to investigate how shared data among operators in cattle industries, mediated through cyberinfrastructure information sharing, may affect the system robustness.
3. We test the use of blockchain as the data sharing cyberinfrastructure.

The outcomes are expected to: 1) facilitate the development of a cyberinfrastructure within the interconnected cattle/transportation system and, 2) benefit existing disaster preparedness. For example, using information sharing during a disease outbreak, producers can become aware of high-risk

areas and can avoid them. In this way, cattle production could likely remain viable for a more extended period and outbreaks could be more easily contained.

We can first assess the impact of truck contamination on the disease transmission with the truck agent following an independent clean-infected-clean cycle. Second, we add an information-sharing functionality such that producers/packers can trace back and forward their trade records to inform their trade partners during outbreaks. Scenario analysis results can show how including indirect contact routes between premises via truck/fomite movements can significantly increase the amplitude of disease spread, compared with equivalent scenarios that only consider animal movement. Also, mitigation strategies informed by information sharing will be designed to dramatically improve the system resilience against epidemics, highlighting the benefit of promoting information sharing in the cattle industry.

Relevance

This project is expected to provide insights into the characteristics of the cyberinfrastructure mediated information-sharing layer that can contribute to resilience in the cattle/transportation system. This work plans to model potential scenarios of information infrastructure development related to cattle industries but can be extended to other supply-chain based infrastructures. The results would assess the possible benefits and vulnerabilities introduced by information sharing. This project also investigates how information sharing could impact interdependent system resilience. The outcomes will facilitate the design of an information infrastructure connected with the cattle/transportation infrastructure. Simulation results will be properly disseminated to decision-makers within the cattle industry, transportation industry, and the government. The interpretation of the results can benefit stakeholders to promote information infrastructure development and facilitate its acceptance by society.

This project fits the Kansas State University Global Food Systems Initiative in solving global food challenges through innovation.

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Community Collaboration in Juvenile Justice

Background

K-State Juvenile Justice Collaborative (K-State JJC), a multi-disciplinary team of experts from Sociology/ Criminology, Communication Studies, Family Studies and Human Services, and Kansas State Research and Extension are collaborating on a project funded by the Kansas Department of Corrections and Kansas Advisory Group. Funding for this effort originates from Title II grants awarded by the Office of Juvenile Justice and Delinquency Prevention, a federal office legislated to support delinquency prevention and reduction, including juvenile justice system improvement. The goal of the project is to increase local capacity and enhance community collaboration in the area of juvenile justice. The team includes Kansas State University faculty members and graduate research assistants from the departments of Sociology and Criminology, Communication Studies, Family Studies and Human Services, Kansas State Research and Extension, and researchers from the Docking Institute and Fort Hays State University.

Description

Working with stakeholders (e.g., local police, schools, correctional staff, court services, youth, and other community stakeholders) in western Kansas, the project team will facilitate community collaboration to enhance local decision-making processes and effectiveness. During the two-year award period, facilitators from K-State Research and Extension, which has a presence in 105 Kansas communities, will work closely with community members to use established dialogue and deliberation procedures to increase knowledge and understanding concerning issues related to juvenile justice in their own communities. These issues include a developmental approach to youth concerns, trauma-informed care, disproportionate minority contact, and best practices in working with specialized groups such as LGBTQI youth. This project is enhanced by combining the knowledge base and experiences of experts in diverse fields with the knowledge base and experiences of local community members. Local communities will be intimately involved in data collection and analysis, identifying youth-directed issues as recognized by community stakeholders. Ultimately, the project aims to empower local communities with a diverse set of tools which can then be utilized to support growth and health of youth, families, schools, and their communities. As a result, a scalable, comprehensive toolkit may then be offered to other counties across Kansas and beyond to widen the scope of impact.



Relevance

Supporting healthy communities and individuals has a direct impact on diverse areas of concern in Kansas, such as Education and the Workforce and Health, Education, Labor and Pensions. Moreover, the funds received are facilitated by the work of Appropriations. The project reflects key features of Kansas State University's strengths, including its strength through interdisciplinary collaboration, its alignment with two colleges' strategic plans relating to research and engagement, its reflection of Kansas State University's land grant mission and research focus as reflected in K-State 2025, and its alignment with the Kansas Congressional Delegation's committee assignments. Federal and state contact information can be found below.

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Microbiomes of Aquatic, Plant and Soil Systems (MAPS): Mediating Sustainability

Background

Microbiome science (understanding the natural role of microbes such as bacteria and algae) is essential to understanding the Earth's ecosystems and is a national priority. The challenge of simultaneously feeding a growing population, sustaining agriculture, maintaining soil quality, and minimizing greenhouse gases and water contaminants requires new data-driven solutions based in a fundamental understanding of the role and dynamics of Microbiomes of Aquatics, Plants, and Soils (MAPS). MAPS mediate disease and productivity of plants, control the quality of water, and moderate greenhouse gas production. MAPS hold the key to assessing and predicting the effects of global environmental change and mitigating ecosystem degradation.

Description

Our project transcends traditional microbiological (Fig. 1) and disciplinary boundaries by harnessing cutting-edge research tools and coupling technologies to rigorous field, experimental, and environmental approaches while working

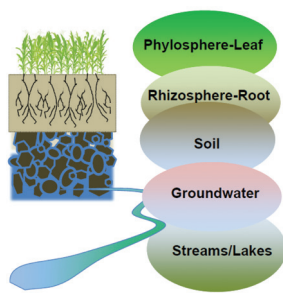


Fig. 1. Overlapping and interacting habitats of microbiomes of aquatic, soil and plant systems (MAPS).

from genes to ecosystems. The resultant discoveries and enabling technologies are providing critical knowledge to enable scientists, engineers, and policy makers to develop approaches to sustain food production systems while preserving biodiversity and ecosystem services. We address five of the eight Grand Challenges outlined by the US National Academies of Science: Biogeochemical Cycles, Biodiversity and Ecosystem Functioning, Climate Variability, Hydrologic Forecasting, and Land Use Dynamics.

Our goals: 1) elucidate MAPS-mediated ecosystem functions useful for predicting ecosystem responses to a variable precipitation regime; 2) develop best practices for promoting MAPS for desired ecosystem services (e.g. plant productivity, soil and water quality); and 3) use our MAPS research to enrich educational and outreach opportunities. We merge perspectives of multiple environmental disciplines and powerful genomic approaches to explore how MAPS regulate the environment and are affected by global change.

Kansas is dominated by agricultural land uses overlaid by a precipitation gradient broadly representative of both current and future precipitation regimes (Fig. 2). It is in these landscapes that society must grapple with food production

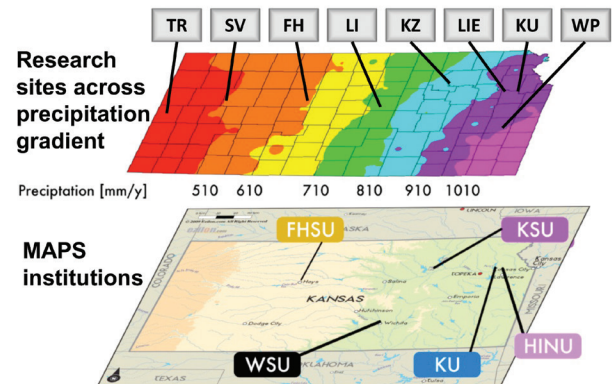


Figure 2: Kansas MAPS involves: University of Kansas (KU), Kansas State University (KSU), Wichita State University (WSU), Fort Hays State University (FHSU), and Haskell Indian Nations University (HINU). The precipitation gradient across the state, covers from arid grassland [510 mm/y] to deciduous forest [1010 mm/y]. Research sites are Tribune (TR), Smoky Valley (SV), Fort Hays (FH), The Land Institute (LI), Konza (KZ), The Land Institute-East (LIE), KU Field station (KU) and Welda Prairie (WP).

while sustaining broader environmental health. Thus, Kansas is an ideal living laboratory to explore our core concepts and build future research capacity.

Relevance

The critical role of microbiomes promoting plant production and other services opens the possibility that microbiomes could be managed for environmental benefits in an analogous way as “probiotics” may aid human health. Multiple recent national science initiatives underscore the relevance of MAPS: 1) the White House announcement of the National Microbiome Initiative which aims to advance microbiome science for our national interests; 2) the international Unified Microbiome Initiative (UMI) seeks to understand the role of microbiomes in all Earth systems, and 3) plant pathologists have created the Phytobiomes Road Map to increase understanding of interactions among microbes and plants.

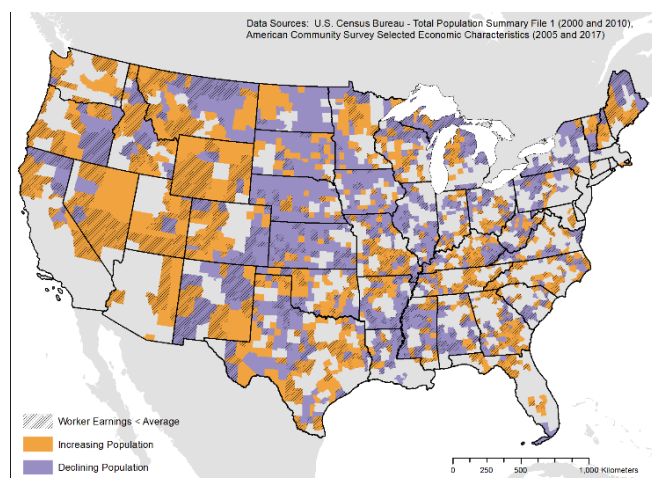
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Engineering Research Center for ENgineered Solutions for rUral RESilience — ENSURE: Food, Energy, Environment, and Infrastructure

Background

Agriculture is a key economic driver in many states and, subsequently, at the heart of many rural communities. However, rural communities across the U.S. currently face many challenges, including population loss, lack of new jobs, lack of understanding of rural challenges, and limited water resources, to name a few. While socioeconomic well-being appears obvious and uneven between urban and rural areas, it can also be uneven within rural areas. A story map (Figure 1, created from U.S. Census Bureau economic and population data) illustrates population change in non-metro areas (i.e., orange=increase, purple=decrease), combined with hatched areas where worker's earnings are less than the national average. These factors create a strong need for understanding the rural landscape—the landscape that anchors our food security—and developing engineered solutions for improving the socio-economic status of rural populations and creating resilient infrastructure.



Description

Kansas State University is partnering with the University of Nebraska (UN-L) and Washington State University (WSU) to develop the Engineering Research Center for ENgineered Solutions for rUral RESilience — ENSURE: Food, Energy, Environment, and Infrastructure. The ERC ENSURE seeks to create sustainable rural communities through engineering innovations and in partnership with rural stakeholders. Rural areas are distributed across the country, and their spread out nature can enable efficient distribution of food, clean energy, and healthy environments. This is particularly important since

80% of the U.S. population lives in cities that are vulnerable to climate change, such as rising sea levels, storm surges, and heat waves. Agriculture is a key economic driver in many states and, subsequently, at the heart of many rural communities. Some examples of ENSURE's research include sustainable and profitable food production, micro-grids which harness wind energy and use solid oxide fuel cells, and recovery of nutrients from animal waste. The vision of the ERC ENSURE is to generate resilient, engineered systems in conjunction with rural stakeholders, creating sufficient capacity in rural communities—across the U.S. and worldwide—to adapt and respond to shocks and adverse conditions.

Relevance

Creating robust systems for enhancing resilience of rural communities is a multi-faceted problem which requires broad and fundamental engineering knowledge, integration with socio-economics, and stakeholder input. The proposed team includes engineering (i.e., biological/ag, civil, chemical, electrical, environmental, and mechanical), public health, sociology, agricultural economics, agronomy, extension agents, and regional and community stakeholders; other participants will be invited based on analyses. Through a convergent approach, the team will create new intellectual merit that would not exist through parallel, discipline-based studies and disparate connections to stakeholders. Innovations created and implemented would increase sustainable economic activity to these regions, while creating an overall more robust infrastructure system.

This project will capture a more complete understanding of the rural landscape as defined by a wide range of stakeholders, allowing the team to understand the challenges and create better engineered solutions. Information gained through the facilitated discussions will be used to create a detailed database. This database will paint a contemporary picture of rural landscapes, highlighting the differences in human and natural capital, and providing the information needed to make informed decisions.

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Microfluidic Organs-on-a-Chip: Bioprinting, Culture, and Diagnosis of 3D/4D Biomimetic Tissues In Vitro

Background

Microfluidic organs-on-a-chip platforms provide an ideal model in vitro to investigate physiological functions of bioprinted tissues or organs in programmable microenvironments with proper mechanical, chemical and biological conditions. The technology recapitulates the biological conditions for basic scientific studies and translational applications including drug development, disease modeling, host-pathogen interactions and personalized precision medicine with reduced need for animal testing or clinical trials. The cultured and diagnosed heterogeneous tissues can be further implanted to replace the damaged structures and functions. It fosters the research and education activities and facilities in K-State among the fields of Engineering, Science, Health, Veterinary Medicine and Agriculture.

Description

To achieve the microfluidic organs-on-a-chip platform, complementary and interdisciplinary technologies are required and will be established, including (1) microfluidic culture and diagnosis, (2) biomaterials, (3) bioprinting and advanced biomanufacturing.

- Microfluidic culture and diagnosis

Microfluidic devices precisely and automatically handle liquids, which facilitates the cell/tissue culture media exchange and maintains a programmable culture microenvironment for organs-on-a-chip. The physiological and health conditions of the 3D tissues are monitored with diagnoses in situ using available immunoassays (ELISA) and molecular diagnosis (PCR) protocols and developing novel biosensors and bio-active probes.

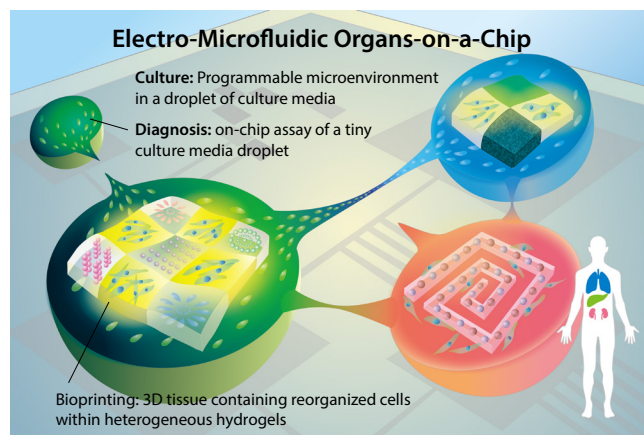
For example, droplets of cell-laden hydrogel solutions, culture media, diagnosis reagents, are efficiently manipulated on electro-microfluidic devices using appropriate electric driving mechanisms, including electrowetting-on-dielectric (EWOD) and dielectrophoresis (DEP). The compact, seamless and all-in-one microfluidic platform bridges the gap between technologies and improve the physiological similarity and functionalities of organs-on-a-chip.

- Biomaterials: hydrogels and cells

Engineering and synthesizing biomaterials and hydrogels to serve as extra cellular matrices for varied cell types are one of our main tasks. Cell lines, primary cells, and stem cells are encapsulated and cultured in 3D biomaterials holding appropriate physical (pore size, porosity, stiffness), chemical (drug composition), and biological (surface ligand) properties.

- Bioprinting and advanced biomanufacturing

Combining state-of-the-art bioprinting and advanced additive biomanufacturing techniques, multiple cell-laden biomaterials (hydrogels) are printed to form heterogeneous biomimetic tissues with high precision, high throughput, and high cell viability. Moreover, the stimuli-sensitive 3D/4D tissue origami allows self-assembled stereoscopic architectures for better biomimetic models in vitro.



Schematic of an electro-microfluidic organs-on-a-chip.

Relevance

The microfluidic organs-on-a-chip platform integrates multiple disciplines in K-State which enhances related research and education across departments and colleges. The cells and tissues of interest span from human, livestock, and plant; the collaborative research and education enrich human health and promote local and national livestock and agriculture industries.

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Building Transformational Innovation-based Partnerships

Background

The Technology Development Institute (TDI) at Kansas State University has a successful track record of providing a broad range of industry-focused integrated business and engineering development services to accelerate the innovation process of new product and processing technologies.

Established as a Kansas Center of Excellence in 1985, TDI serves to advance technologies, people, and companies through collaborative engineering and business partnerships in the following ways:

- From 1995 to present, TDI has completed more than 2,800 product design, design/build custom automation, product testing, and new venture development projects with 600+ businesses and organizations throughout the United States.
- TDI actively supports applied research and development efforts on diverse technologies such as aircraft cabin air filtration, noncontact concrete railroad tie inspection, and precision agriculture.
- Since 1995, TDI has continuously operated an engineering/business student internship program that has served to accelerate the hands-on learning of over 600 undergraduate and graduate students.
- Since 2004, TDI has served as a funded University Center for the U.S. Department of Commerce Economic Development Administration (EDA). In this capacity, TDI focuses on accelerating innovations through building innovation networks and collaborations with individual companies, communities, and regions.
- In 2019, TDI was awarded a multi-year contract with the Small Business Administration (SBA) to establish the Great Plains Technology and Manufacturing Cluster (GPTMC) as part of SBA Regional Innovation Cluster initiative. GPTMC is one of 14 designated clusters nationwide.

Description

Kansas State University proposes to significantly expand and amplify TDI's innovation capacity in support of university faculty/student research teams through the expansion of early-stage, hands-on, proof-of-concept partnerships forged with university researchers and industry partners. TDI's industrially-experienced, hands-on, technical and business professionals, will work in partnership with university research teams to rapidly construct university/industry open innovation networks to accelerate research projects, directly engage technology brokers and suppliers, scout prospective industry partners, and directly contribute industrially-experienced technical and business expertise to harden early-stage university innovations.

Equipping TDI to serve as an early-stage university proof-of-concept partner will:

- Enable faculty/student research teams to capture more sponsored research funding through demonstrating their teams are equipped for early market validation in the discovery process, and to carry their innovations further in the subsequent technology transfer/commercialization processes.
- Employ a systematic development process that enables faculty/students to focus on learning and discovery and TDI to focus on hardening, refining, and transitioning innovations to industry partners.
- Equip TDI to host an open and accessible university makerspace to increase student experiential mentoring via industry-experienced design and development professionals.
- Position the university to have greater engagement and economic impact with the companies, communities, and regions served.

Relevance

Being able to accelerate the university transformation process of converting scientific discoveries into marketable products and services, is not only vital to the health of the university innovation ecosystem, it is increasingly critical in order to sustain financial support from federal/state agencies and industry sponsors. In addition, engaging students actively in this innovation acceleration process better equips today's university research teams and tomorrow's future graduates to have a greater near-term impact on society, and the state and nation's economies.

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Supporting Accountability and Program Improvement Through Evaluation

Background

The Office of Educational Innovation and Evaluation (OEIE) is a unit in the College of Education at K-State. Established in 2000, OEIE's mission is to assist educators and researchers in government, nonprofit, and other organizations across the country and internationally to demonstrate program impact and accountability. These programs and this work support K-State's land-grant mission.

Description

OEIE has provided research and evaluation services for over 360 projects exceeding \$500 million - \$20M in evaluation alone - in sponsored funding from a variety of agencies such as NSF, USDA, DoDEA, and the U.S. Department of Education. In addition to working directly project PIs, OEIE has also worked at the agency level to provide evaluation services for entire programs. Some examples of these include:

- Collaborating with NSF EPSCoR to enhance evaluation processes within the program.
- Working with the 4-H Military Partnerships program, OEIE conducted an evaluation of the Teen Program that is part of the Air Force's Child and Youth Programs (CYP) at US and international air bases. The evaluation provided data to the program for ongoing strategic planning and reporting.
- Working with the National Science Foundation to conduct a 10-year review and evaluation of the Research in Disabilities Education (RDE) to document impact and outcomes.
- Contracting with USDA, OEIE conducted a review and evaluation of the 2014 Farmers Market and Local Food Promotion Programs.

Other Innovations in Evaluation:

- OEIE built and maintains the Program Evaluation and Reporting System (PEARS), a sophisticated web-based evaluation and data-management application. PEARS meets the evaluation and reporting needs for SNAP-Ed programs in 30 states and 5 statewide cooperative extension programs, and growing.
- Through PEARS, OEIE has the opportunity to work at the program level to engage and provide feedback on evaluation frameworks strategies to help SNAP-Ed better document and report program impacts.
- In 2014, OEIE worked with the K-State Research Foundation to spin out Piestar, Inc. (www.piestar.com) Piestar focuses on developing and implementing reporting tools for large multi-institution research projects. Currently, the company serves clients in a growing list of research programs, including U.S. Agency for International Development (USAID) Feed the Future, NSF EPSCoR, NIH IDeA, and USDA NIFA.

Relevance

The enactment of the Foundations for Evidence-Based Policymaking Act (P.L. 115-435) in January 2019 means the need for quality evaluation services will continue to grow and be a priority. OEIE has the tools and personnel to expand its current reach to meet these needs. OEIE in the College of Education is dedicated to the development and implementation of effective strategies and technologies for assessing and evaluating educational organizations and programs. The COE and OEIE are committed to actively promoting quality assessment and evaluation practices, providing evaluative services that are designed to meet the specific needs of our clients from school systems, higher education, as well as public and private organizations.

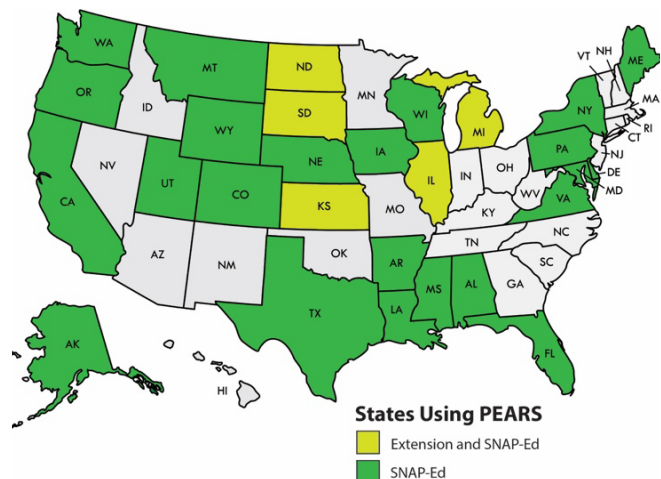
Agency Contact Information

National Science Foundation (NSF) Established Program to Stimulate Competitive Research (EPSCoR)
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United States Department of Agriculture (USDA) Food and Nutrition Service (FNS)
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Diversity and Inclusion in Educational Settings

Background

The College of Education (COE) at Kansas State University recognizes its important and continuing work of preparing its students for an increasingly diverse and changing world. Significant work is being done in the college that positions it as a national and international leader in addressing culturally responsive teaching and learning through its programs and research. The COE's longstanding commitment to diversity can be seen throughout the collective work of its departments, center, and programs since the early 1990s. Guiding these initiatives is the COE mission of "Preparing educators to be knowledgeable, caring, ethical decision-makers in a diverse and changing world."

Description

The COE is creating educational programming and conducting social science research related to pedagogical practices that are culturally relevant and are informed by the context of the learner and the educator through a number of programs, projects, and research endeavors.

- The Center for Intercultural and Multicultural Advocacy, known as CIMA, implements programs and conducts research that has national and international significance. CIMA originated the BESITOS program model that has supported 95 bilingual/bicultural students to graduation and placement in English as a second language education. Of these, 35 have gone on to graduate school with 21 to date completing and serving in Kansas. CIMA has supported over 850 migrant students in obtaining GEDs, and has served over 400 migrant students in postsecondary education. Several CIMA programs have won national and international awards. In addition, CIMA researchers have produced highly ranked books and peer-reviewed publications.
- The COE is a partner in the Kansas Louis Stokes Alliances for Minority Participation, or LSAMP, funded by the National Science Foundation. This award funds four colleges at K-State that partner with community colleges in Kansas designated as Hispanic serving institutions, or HSI. This pipeline projects promotes the recruitment, retention, and graduation of underrepresented minorities in STEM. COE faculty provide expertise and professional development for their partners related to culturally responsive practices in recruitment, retention, and teaching. We are also engaged in research related to these best practices.

- The COE also partners with units within the Colleges of Arts and Sciences and Engineering to sponsor an annual Indigenous People's Day conference. Each year focuses on topics related to culture, context and education.
- Commitment to and inclusion of culturally responsive teaching and learning is demonstrated by research conducted by faculty in all departments in the COE.
- The Michael Tilford Conference provides an opportunity for faculty, staff, and administrators at Kansas Board of Regents institutions to approach diversity in higher education by examining the challenges and opportunities in Kansas. The conference is designed to build awareness of multiple dimensions of diversity, related practices of inclusion, and the transformation of higher education in Kansas. The Kansas State University Tilford Group is an outgrowth of the statewide Michael Tilford Conference on Diversity and Multiculturalism. Faculty and staff within the COE work with others across campus on this initiative to promote multicultural curriculum transformation.

Relevance

The changing demographics in society and the workforce highlight the need for an inclusive approach to teaching and learning. K-State is committed to continuing our work in these areas to support and improve educational experiences for all students.

Agency Contact Information

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Office of English Language Acquisition (OELA)
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National Science Foundation:
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Furthering Ethical and Responsible Research

Background

The complexity and broad impact of 21st century STEM demands that researchers be more attentive to the ethical and social implications of their work. However, training in these areas is limited and, where it is available, often not well-integrated with STEM practice.

The establishment of rules about Responsible Conduct of Research (RCR) is a more prescriptive attempt to ensure that science is conducted ethically, produces reliable results, and is communicated honestly with the public. Unfortunately, RCR training that focuses on narrow, rule-based prohibitions has been shown to have limited scope and impact.

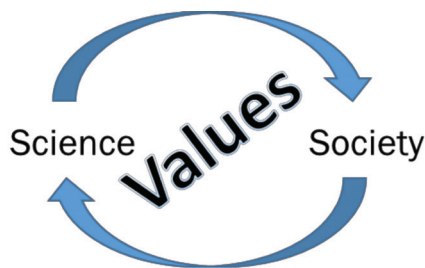
This project aims to remedy the shortcomings of RCR training by investigating the link between RCR compliance and scientists' views about the goals and values of science. It will improve our understanding of the ethical and social dimensions of STEM by investigating new methods for integrating humanities and social sciences into STEM training.

Description

This inter-disciplinary collaboration between K-State's Philosophy and Physics departments explores an underexamined determinant of RCR compliance: the goals and values that inform everyday scientific practice. Examples of such practices include identifying research topics, recruiting research teams, designing research plans that will yield robust evidence, and selecting and recruiting research participants. Each of these tasks requires making value judgements: about which policy problems are most important, whose perspectives are important, what experimental risks are worth taking, and when and how results should be shared with the public.

This project will investigate scientist's understanding of the aims of science and the effect such attitudes have on their motivation to engage in responsible conduct of research. Seeded by an initial, three-year grant from the National Science Foundation the project has two strands. The first strand gathers K-State science faculty to discuss their views about the goals and value of science and their relationship to good scientific practices. Scientists will discuss questions such as what role science should be playing in public policy, who is responsible for controlling unintended consequences of science, and what possible trade-offs there are between searching for truth, predictive accuracy, and social benefit. The second strand of the research will develop an instrument for evaluating the attitudes of scientists towards the aims of science and their motivation to engage in RCR. This instrument will be the basis of further study into the most effective means for promoting responsible conduct amongst scientists.

The project is one of several initiatives at Kansas State to better integrate STEM with humanities and social science to help improve STEM research and education.



Relevance

The project will enhance efforts to promote RCR by identifying ways in which RCR principles serve or possibly hinder the goals of science. The hope is that RCR training can be made less burdensome and more productive by having it better incorporate scientists' values and language. By deepening engagement with the broader social context of science, this project will also improve understanding of a range of ethical challenges, including:

- (i) potential misapplication of dual-use research,
- (ii) the social impact of research,
- (iii) diversity in science, and
- (iv) duties to engage with the public.

The team aims to help scientists translate their own goals and values into good practices of teaching, mentoring, and research, and will help them shape future science training by jointly clarifying how ethical STEM practice fits in to general goals of science. The project will need continued funding to meet its goals to:

- (i) modify RCR training to be more effective,
- (ii) develop new methods for including ethical decision making in STEM training,
- (iii) integrate ethics and humanities training with science training,
- (iv) foster intentional recognition by researchers of the ethical and social dimensions of their work, and
- (v) improve broader impacts of science.

Agency Contact Information

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CNH: Coupled Climate, Cultivation, and Culture in the Great Plains: Understanding Water Supply and Water Quality in a Fragile Landscape

Background

Our work focuses on the Smoky Hill watershed, in the Central Great Plains (CGP), a region with longstanding water quality and quantity concerns. In addition to multiple bio-physical stressors, the CGP has a socio-economic system already overwhelmed with population shifts, concentrated land tenure, dependency on a highly variable limited water supply, economic uncertainty, cultural resistance, and skepticism of climate science.

Description

Water is a critical component of Earth's system; its relative abundance and quality drive native and managed ecosystems, as well as human enterprises on the landscape. Freshwater is central to agriculture, industry, residential development and other economic aspects, providing needed an essential ecosystem. Existing freshwater resources are being challenged by increasingly unsustainable land and water use. The distribution, abundance and quality of freshwater supplies will be affected by projected climate change and variability. Unless landscapes are managed proactively, sustaining even present levels of ecosystem goods and services from aquatic systems will be impossible. Among the most pressing environmental challenges related to freshwater are how to formulate and implement sustainable, science-based, strategies to adapt to climate variation, land use land cover (LULC) change, and other sources of human development. To achieve sustainable landscape management, integrative mechanistic models are needed that account explicitly for human-landscape interactions and incorporate detailed, well-developed, coupled models of hydrosystems, aquatic ecosystems, and human system responses to a changing climate. The purpose of our research is to develop coupled integrated mechanistic models of these systems in the Central Great Plains (CGP) – the hydrosystem, the human system, and the aquatic ecosystem – utilizing an agent-based decision framework to evaluate whole-system response to climate variation scenarios derived from historical data and downscaled climate projections over different time scales. Finally, policy optimization modeling using this framework will help identify effective policy strategies to achieve water resource and ecosystem resilience in the face of human cynicism about climate change.



Dry Smoky Hill River

Relevance

Our research has the potential to transform the science supporting water sustainability efforts on several fronts.

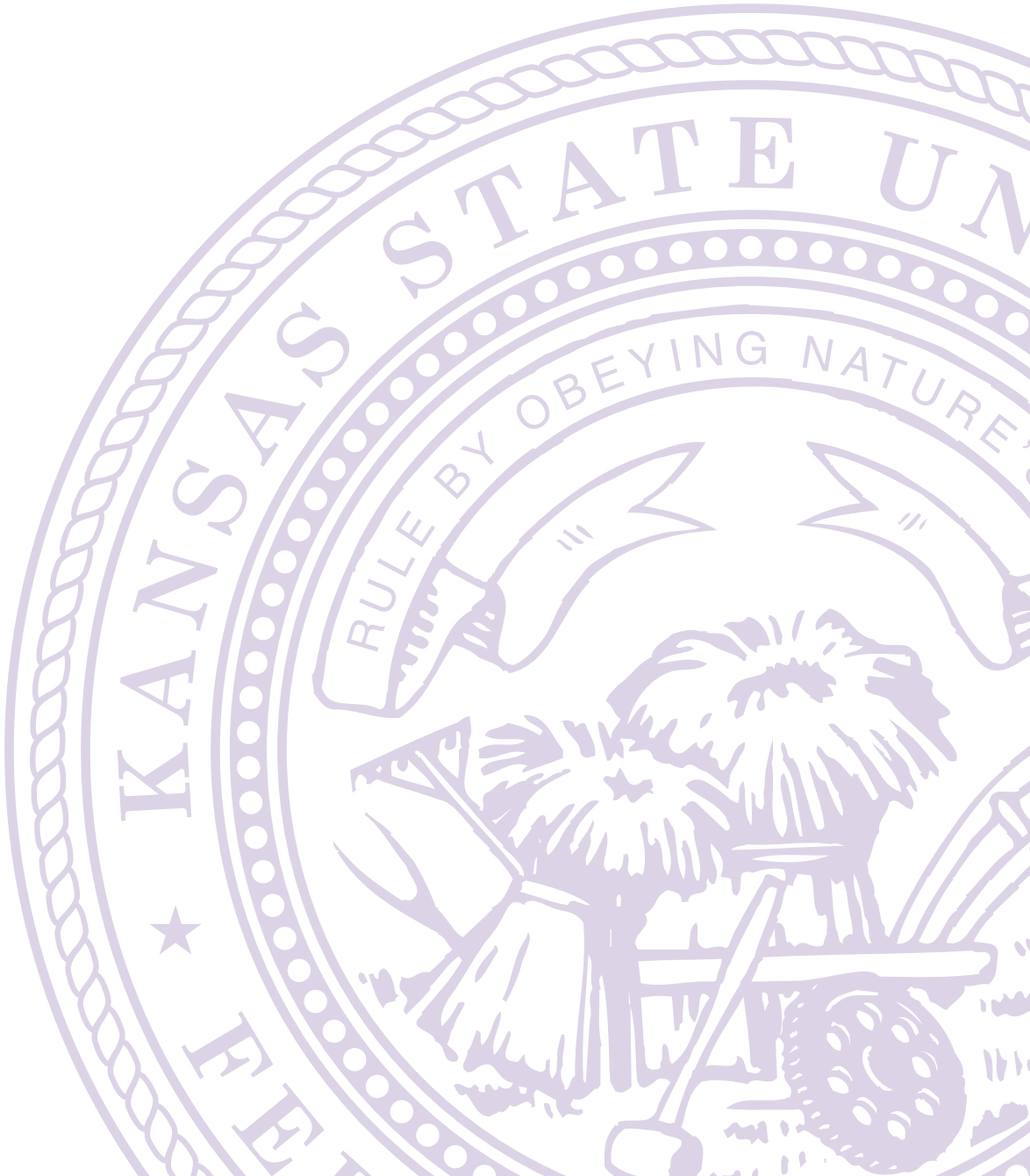
Specifically, our research will:

- (a) improve upon current climate downscaling techniques using a modified ensemble-mean approach and stochastic downscaling methods
- (b) produce qualitative and quantitative understandings of decision-maker behavior in the CGP
- (c) develop a spatially-explicit, landscape-scale synthesis of existing ecological data to understand how climate changes and watershed alterations impact riverscape-scale biodiversity
- (d) facilitate understanding of how climate change will interact with a range of other stressors to impact the functional capacity of wetlands
- (e) develop a new theoretical modeling framework for understanding integrated human-natural systems, especially with how to endogenize cultural factors
- (f) provide mathematical models for representing such systems, and solution approaches for the models, and
- (g) produce a robust policy optimization model that integrates interactions between human, water and ecological systems to maximize adaptability and sustainability in the face of future climate change.

Agency Contact Information

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DEFENSE



Nuclear Radiation Detector and Systems Development

Background

National security concerns arise when terrorists and rogue states pursue nuclear weapons development. The United States Departments of Defense (DoD), Energy (DOE), and Homeland Security (DHS) must identify security barriers, and develop new technologies to detect and mitigate these threats. National strategic research must include improved nuclear detectors and sensor systems for safeguard programs. Establishment of a center dedicated to development of radiation sensors and radiation measurement techniques is a direct response to national security needs.

In addition to faculty who are leaders in several areas relevant to nuclear detection, Kansas State University (K-State) has nuclear capabilities unique to the Midwestern region of the United States. The Semiconductor Materials and Radiological Technologies (SMART) Laboratory at K-State, one of the largest and most diverse university-based, radiation-detector development laboratories in the United States, is dedicated to research and development of new, innovative radiation-detector technologies. Over the past 17 years, the SMART Lab has benefited from numerous government and corporate sponsors, including the DoD, NSF, U.S. DOE Nuclear Engineering Educational Research program (NEER), and U.S. DOE NNSA office, totaling more than \$25 million in extramural research support. A class-100 clean room and a recently installed dry room (<0.1% humidity) are dedicated to the fabrication of innovative radiation detectors.

The radiation-detector development group at K-State is involved in groundbreaking projects that emphasize development, design, and fabrication of innovative nuclear-radiation-detector materials and devices for applications such as nuclear materials monitoring, radiation imaging, radiation dosimetry, and remote radiation sensing. The SMART Lab has extensive materials purification and crystal-growth facilities, semiconductor detector processing fabrication equipment, electronics design and testing equipment, and radioactive calibration sources and detection calibration facilities, allowing the lab to be a fully operable facility for radiation-detector design and development. SMART Lab detectors have been featured in local and national news, and 21 U.S. patents have been awarded to SMART Lab researchers for novel detector designs, in addition to five Research & Development (R&D) 100 Awards for innovative detector designs. The K-State nuclear program has conducted seminal civil defense research and maintains a world-class reputation in radiation shielding research. U.S. DOE, DHS, and DoD laboratories are currently testing detectors from the SMART Lab. K-State operates the only university research nuclear reactor in an 11-contiguous-

state region within the Great Plains. The K-State nuclear reactor is used extensively to test and characterize detector technologies developed in the SMART Lab. Additional support is provided by the K-State Electronics Design Laboratory (EDL), staffed with professional electronics engineers with combined experience exceeding 80 years. Proximity to the Fort Riley military installation offers potential dual-use development and testing in a secure environment.

Description

The mechanical and nuclear engineering (MNE) and chemical engineering (CHE) departments at K-State are renowned for innovative radiation-detector research. In addition to the K-State TRIGA Mark II nuclear reactor and the EDL, K-State seeks to combine and exploit these resources to establish a National Center for Strategic Applications of Nuclear Sensors (SANS). This interdisciplinary center will have four primary missions: (1) explore new radiation-detector materials, (2) design and fabricate novel radiation detectors with unprecedented performance, (3) develop integrated detector systems and arrays vital to national security, and (4) train the next generation of leaders in detector technology needed to replace the first generation of nuclear-trained scientists and engineers whose ranks are rapidly dwindling due to retirements.

Relevance

A combination of faculty, expertise, and facilities will make the SANS center foremost in nationwide university- and government-based radiation-detector research, complete with materials research, neutron and gamma-ray detector development, electronics design, wireless detection technologies, and radiation monitoring and imaging devices. Establishment of the SANS center is a direct response to national security needs for development of new radiation detectors to mitigate nuclear materials. Detector development is highly relevant to a variety of radiation-detection applications such as stockpile stewardship, homeland security, astrophysics and space satellites, medical imaging, oil-well logging, active personnel dosimetry, high-resolution gamma-ray spectroscopy, and alternative methods for neutron detection.

Agency Contact Information

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Military-Connected Learners: Research & Teaching

Background

The College of Education (COE) at Kansas State University is committed to a military/veteran focus as part of our work. The needs and strengths of military personnel, veterans and their families have been systematically addressed by the faculty of the COE, who educate teachers, principals, superintendents adult educators, school counselors, special educators, postsecondary advisors, and college student personnel support staff.

Description

The college's award-winning military initiative is a collegewide program that has been in place for several years. The focus of the initiative is military-connected learners at all education levels, recognizing especially that veterans in college face challenges in adjusting to a university culture that differs greatly from the highly structured military culture. Therefore, this college is designing programs and conducting research related to military-connected learners.

- The college, in partnership with the Kansas State Department of Education, was awarded a Troops to Teachers grant to establish a robust system to recruit, train, and hire military veterans and dependents for Kansas classrooms.
- The college became one of the first 100 universities to join Operation Educate the Educators, a nationwide Joining Forces initiative that was given guiding principles set forth by the American Association of Colleges for Teacher Education and the Military Child Educational Coalition.
- The school counseling program has developed a Certificate of Competence in Counseling Military-Connected Students for school counselors and candidates in counselor education graduate programs based on the theoretical and research framework and best practices in parent/family counseling and education strategies and interventions.
- The Military Child Education Coalition awarded the College of Education the 2014 LTG (Ret.) H.G. "Pete" Taylor Higher Education Partnership of Excellence award in recognition of our work with school partners in educating military-connected students.
- A faculty-developed leadership training program, the Brigade Command Team Spouse Development Program, was awarded the Malcolm Knowles Award for Outstanding Program in Adult Education in 2010.
- The college produced a widely disseminated documentary, "A Walk in My Shoes: Military Life" (<https://coe.ksu.edu/walk-in-my-shoes/military-life.html>), in which seven people currently connected to the College of Education — retired soldiers, spouses, a child and educators — share their perspectives on the rewards and challenges of being

connected to the military. Topics include the realities of deployments for the family and the soldier, post-traumatic stress disorder (PTSD), and the social/emotional needs of military-connected students.

- Our adult education graduate program is active at Fort Leavenworth and has awarded nearly 1,000 graduate degrees at the Command and General Staff College in the past 25 years. The Security Studies program in the College of Arts and Sciences expands these efforts by offering interdisciplinary M.A. and Ph.D. degrees, that combine History and Political Science, for students interested in national security, world politics, transnational problems and international affairs.
- Faculty and graduate students conduct research related to timely topics in education. Several recent dissertations have addressed military and veterans' issues, such as the impact of deployment on school behavior, creativity and cognitive development in military courses, effects of stress in the military classroom, military faculty self-efficacy, and faculty development at military colleges.

Relevance

The College of Education is making a significant contribution to the education of military-connected students and veterans and is impacting the education of our undergraduate and graduate students in their knowledge of and appropriate pedagogy and practice for veterans, members of the military and their families. Building on this work and expanding partnerships will position our program for additional research opportunities that can further help educators better understand the needs of military-connected students.

Agency Contact Information

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Office of Elementary and Secondary Education
Frank Brogan, Assistant Secretary
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Department of Defense Education Activity (DoDEA)
Thomas Brady, Director
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Improving Mental Health and Well-being by Building Healthy Relationships and Ending Violence

Background

Healthy relationships are fundamental to individuals' overall health and well-being. In fact, individuals who have a healthy relationship:

- Live longer
- Heal faster
- Have stronger immune systems
- Have better heart health (e.g., lower blood pressure, less heart disease, reduced risk of heart attack)
- Experience less stress
- Experience lower rates of depression
- Feel better about themselves
- Are happier

Many Kansas families experience repeated transitions, prolonged stress, unstable situations, and poverty, which negatively effects relationships. Every person deserves the opportunity to have healthy relationships and to live free from the experience of interpersonal violence, toxic stress, and social immobility. Researchers, teachers, and outreach professionals in K-State's School of Family Studies and Human Services (FSHS) are dedicated to contributing to the development and enhancement of healthy relationships to improve the mental health and well-being of individuals and families.

Description

To address these issues, applied research, clinical services, and programming are underway across units in the School of FSHS to:

1. support healthy relationships across life-course transitions, cultures, family development, and in long-term relationships;
2. assess the risk markers of intimate partner violence across generations;
3. support healthy partner and/or or parenting relationships;
4. develop and test a violence risk assessment tool to guide prevention and treatment of partner violence efforts in military families;
5. assess the impact romantic relationships and parenting behaviors have on child outcomes;
6. assess the risk markers of sexual assault;
7. implement and evaluate a relationship education program for at-risk youth;
8. study communication technologies on relationships between former partners and between parents and children following divorce;

9. support and encourage parent-child communication about health and well-being;
10. develop technology to make relationship research accessible to all;
11. develop research-based community programs that focus on strengthening relationships in the context of individual family units and the communities where they reside.

Faculty in K-State's School of FSHS have received grants and contracts to support research on building healthy relationships, preventing partner violence, and supporting family resilience.

Relevance

Adults who are in healthy relationships have better physical health, fewer emotional problems, and are more financially successful. Children who grow up in homes with parents in healthy relationships also do better in all aspects of life.

Faculty in K-State's School of FSHS in the College of Health and Human Sciences are conducting applied research that support healthy relationships. They are receiving private, state, and federal funding for their research and have received national and international recognition for their efforts.

Agency Contact Information

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Family and Youth Services Bureau
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Deputy Assistant Secretary of Defense for Military Community and Family Policy
Ann Thomas Johnston

Immersive 3D/4D Visualization for Education and Research

Background

Immersive environments and visualization technologies have catalyzed a revolution in education, storytelling, and research. Rich interactive simulations have proven effective at improving the educational experience in fields such as engineering, architecture, health care, and military operations. Similarly, these simulations are used in groundbreaking basic research in STEM fields. We have extensive knowledge and expertise in developing these kinds of technologies to support STEM training and research. We house state-of-the-art technology and manufacturing laboratories (including a virtual reality lab) that are used to enhance university education through the creation of immersive digital environments and analog replicas. Examples of key contributions to education and research:

- 3D visualizations and 3D prints for architectural and medical purposes.
- 20' x 8' Panoramic Immersive Screen for virtual representations and experiences in research.
- 3D/4D virtual reality games using state-of-the-art computer hardware and software for education.
- Pedagogical expertise in problem-based learning.

Interdisciplinary expertise of faculty in the College of Architecture, Planning and Design can be leveraged to contribute new educational opportunities, such as serious gaming, as well as novel research opportunities in info- and geo-visualization.

Description

Educational Opportunities: Integration of serious gaming (where learning is the primary goal) may assist in building a diverse workforce and increasing opportunities for innovation while encouraging critical decision-making strategies. Simulations incorporated in the serious games can provide project-based experiential learning leading to better-prepared graduates entering the workforce and the public to learn critical social and environmental issues today.

Military Training Opportunities: Immersive technologies and environment offer a novel way to support the training of troops to help in navigation and situational awareness. We are using these technologies to better understand how spatial memory is retained and how we might utilize this knowledge to support the wayfinding and navigational skills for our military personnel.

Research Opportunities: Information visualization and geo-visualization are technological methods used in research throughout the sciences and humanities. Our area of expertise include creating high-fidelity virtual simulations of real and imaginary places, across multiple spatial and temporal scales.

This expertise provides an opportunity to conduct research in environmental perception and spatial cognition, as well as engaging in the visualization of future alternatives for scientific and engineering assessment.



The adaptation of visualization technology to support these efforts combined with the recreation of these forms holds promise for improving education and scientific outreach.

Relevance

Incorporation of problem-based learning enhanced by visualization technology and serious gaming may increase the efficacy of STEM education and military training. Likewise, the ability to create virtual environment with high realism enables us to better understand how landscape and built-environment landmarks influence spatial memory. Finally, these same technologies can be used to support research in STEM fields by exploring realistic environments and conditions, and how interventions are magnified.

Agency Contact Information

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Supporting Accountability and Program Improvement Through Evaluation

Background

The Office of Educational Innovation and Evaluation (OEIE) is a unit in the College of Education at K-State. Established in 2000, OEIE's mission is to assist educators and researchers in government, nonprofit, and other organizations across the country and internationally to demonstrate program impact and accountability. These programs and this work support K-State's land-grant mission.

Description

OEIE has provided research and evaluation services for over 360 projects exceeding \$500 million - \$20M in evaluation alone - in sponsored funding from a variety of agencies such as NSF, USDA, DoDEA, and the U.S. Department of Education. In addition to working directly project PIs, OEIE has also worked at the agency level to provide evaluation services for entire programs. Some examples of these include:

- Collaborating with NSF EPSCoR to enhance evaluation processes within the program.
- Working with the 4-H Military Partnerships program, OEIE conducted an evaluation of the Teen Program that is part of the Air Force's Child and Youth Programs (CYP) at US and international air bases. The evaluation provided data to the program for ongoing strategic planning and reporting.
- Working with the National Science Foundation to conduct a 10-year review and evaluation of the Research in Disabilities Education (RDE) to document impact and outcomes.
- Contracting with USDA, OEIE conducted a review and evaluation of the 2014 Farmers Market and Local Food Promotion Programs.

Other Innovations in Evaluation:

- OEIE built and maintains the Program Evaluation and Reporting System (PEARS), a sophisticated web-based evaluation and data-management application. PEARS meets the evaluation and reporting needs for SNAP-Ed programs in 30 states and 5 statewide cooperative extension programs, and growing.
- Through PEARS, OEIE has the opportunity to work at the program level to engage and provide feedback on evaluation frameworks strategies to help SNAP-Ed better document and report program impacts.
- In 2014, OEIE worked with the K-State Research Foundation to spin out Piestar, Inc. (www.piestar.com) Piestar focuses on developing and implementing reporting tools for large multi-institution research projects. Currently, the company serves clients in a growing list of research programs, including U.S. Agency for International Development (USAID) Feed the Future, NSF EPSCoR, NIH IDeA, and USDA NIFA.

Relevance

The enactment of the Foundations for Evidence-Based Policymaking Act (P.L. 115-435) in January 2019 means the need for quality evaluation services will continue to grow and be a priority. OEIE has the tools and personnel to expand its current reach to meet these needs. OEIE in the College of Education is dedicated to the development and implementation of effective strategies and technologies for assessing and evaluating educational organizations and programs. The COE and OEIE are committed to actively promoting quality assessment and evaluation practices, providing evaluative services that are designed to meet the specific needs of our clients from school systems, higher education, as well as public and private organizations.

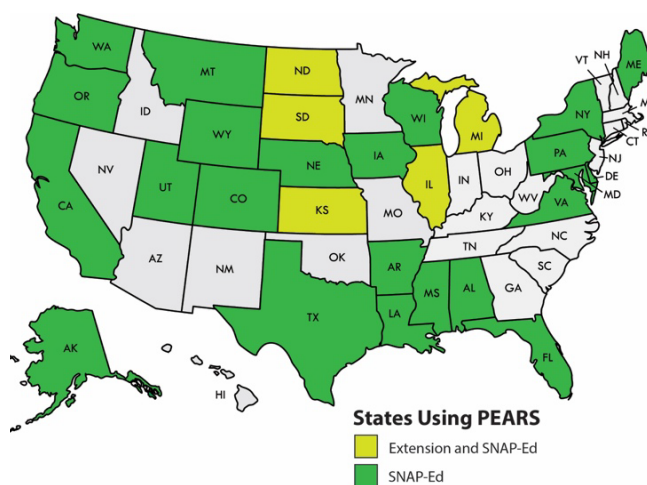
Agency Contact Information

National Science Foundation (NSF) Established Program to Stimulate Competitive Research (EPSCoR)
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Department of Defense Education Activity (DoDEA)
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ENERGY AND WATER



J.R. Macdonald Laboratory: Atomic, Molecular, and Optical Physics Research Using Ultrafast Lasers

Background

One of the first steps to truly controlling the world around us is understanding it. When the control sought is over the chemical reactions that underly energy production or materials synthesis, for in-stance, then one must understand the dynamics of atoms and molecules at the quantum level. One must also understand how light — our primary tool for control — impacts them.

This goal is the domain of atomic, molecular, and optical physics (AMOP). The fundamental research carried out in AMOP thus enables and underpins later technological applications — ideally, in this case, control of matter at the quantum level which is one of the grand challenges identified in both Department of Energy and National Research Council publications.

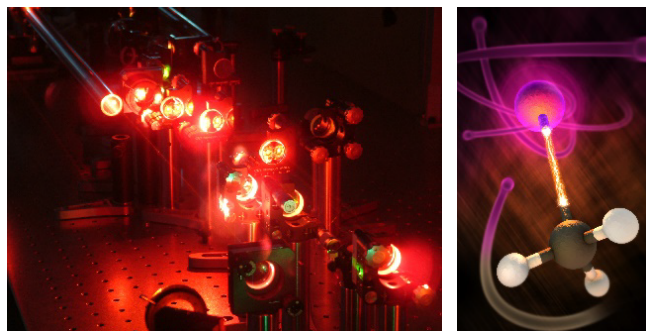
Since the natural timescale of atomic motion in a chemical reaction is tens of femtoseconds (one femtosecond is 10⁻¹⁵ seconds), both their study and their control require laser pulses of this duration — generally known as “ultrafast” laser pulses. Diving even deeper to understand the behavior of the electrons, which ultimately control the reactions, requires pulses 1000× shorter still (attoseconds). The pulses employed in such AMOP studies range in wavelength from mid-infrared to ultraviolet to X-ray and often have very high intensities.

Description

The J.R. Macdonald Laboratory (JRML) — a national and world leader in AMOP for more than 35 years — employs three ultrafast lasers to support the re-search of 5 experimental faculty, their groups, and their collaborators from other institutions. The lasers produce near-infrared (780-nm) pulses roughly 25 femtoseconds long at a rate of 1000–10000 pulses/second with 2–20 millijoules of energy per pulse; the exact combination of parameters differs by la-ser. We convert these pulses to the other wave-lengths needed via both home-built and commercial devices.

Even so, these systems cannot supply all the capabilities we need, so several of our faculty also carry out part of their research at large national facilities like the Linac Coherent Light Source (LCLS) and its imminent upgrade (LCLS-II). Many of the same detection schemes — a JRML specialty — can be used both places, enabling the light-source work to complement our lab-based work and vice versa.

Although the core research in JRML has long been supported by a group grant from the Department of Energy, various aspects of our research have also been supported by other agencies. For instance, we are currently applying to the NSF-MRI program to upgrade our laser infrastructure through the addition of a system with 10× more pulses/second. Given that the productive lifetime of an ultrafast laser is typically around 7 years, we must regularly seek such infrastructure funds along with the funds to build out the environmentally stable, low-level clean rooms needed to house them.



Working alongside the experimentalists in JRML are 4 theorists who strive to develop the tools to treat these complicated systems quantum mechanically, thereby providing the precise mathematical understanding needed to generalize the results. Their work, in part, involves high-performance computing utilizing both local and national computational resources.

Relevance

Tomorrow’s technology is fueled by today’s basic research, and the J.R. Macdonald Laboratory is a significant player in the basic research of controlling atoms and molecules in chemical reactions using tailored, ultrafast laser pulses. Unfortunately, U.S. investment in this important area generally lags Europe and China despite the fact that students and postdocs trained in AMOP are in demand both at national labs and in high-tech industries — as our own graduates have amply demonstrated.

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Affordable and Suitable Housing

Background

The US Department of Housing and Urban Development (HUD) defines affordable housing as the condition of spending less than 30% of one's income on housing (including utilities). Cost-burdened is the designation by HUD of spending 30-50% of income on housing, and any greater percentage is designated as severely cost burdened. High rates of cost-burden are a significant health risk to Individuals, families, and communities may experience significant health risk when burdened by high housing costs. Cost-burdened individuals may work longer hours or multiple jobs, have less income to purchase food and medicine. They may experience elevated stress, all of which adversely impact health. This burden is shared with the community through diminished economic activity, educational achievement, worker productivity, and increased burden on the healthcare system.

Description

Recognizing the need for community-based solutions and engaging stakeholders in local housing systems, faculty in K-State's College of Architecture, Planning, and Design partnered with a campus unit, K-State's Institute for Civic Discourse and Democracy, as well as communities across the state. These projects have included:

- a multi-year public dialogue process in one of Kansas' most cost-burdened counties, known as the Community Solutions to Affordable Housing project (funded by the Kansas Health Foundation);
- assessment of housing quality in a rural Kansas community;
- and the development and prototyping of a net-zero energy affordable home.

The Net Positive Studio (as the latter effort is known) is an interdisciplinary research and design effort in the College of Architecture, Planning, and Design to develop housing prototypes that are affordable, safe, high-quality, environmentally sensitive, and functional while demonstrating broad tenants of sustainability: energy and environmental conservation, economic tenability, and positive social and community impact. In advancing a dialogue and solutions for affordable housing in the 21st century, the service learning effort counters multiple dimensions of our state's housing crisis. In academic year 2019-20, faculty and students will partner with the Stafford County Economic Development Corp (Stafford Ecodevo) to research, design, and build an affordable, net-zero prototype home for a community in Stafford County. The project will demonstrate a broad range of cutting-edge technologies and construction methods.

Relevance

Despite widespread acknowledgement of the problem of affordable housing by public agencies and non-profit organizations, community survey data reveals that local citizen engagement in developing solutions has been sporadic and insufficient to address the increasing demand for housing available to those with low and moderate income. Projects led by the College of Architecture, Planning, and Design and the Institute for Civic Discourse and Democracy involve students in service learning to seek real world solutions by assessing need, informing policy, and developing housing design prototypes.

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Additive and Laser-Based Manufacturing for Energy, Aerospace, Micro/Nano Electronics and Biomedical Applications

Background

Advanced manufacturing processes such as additive manufacturing (AM) and laser micro/nano machining have demonstrated to provide unique ways for making customized, complex structures at the macro, micro and nano scale for a variety of engineering applications within the energy, aerospace, biomedical, and electronics industries. With the addition of new faculty members in the IMSE, ECE and MNE departments in recent years, we have formed a team with critical expertise and experience to push the advanced manufacturing research to a new level at K-State.

Description

Currently several faculty members in K-State's Carl R. Ice College of Engineering engage in AM and laser-based manufacturing research, with the majority in the IMSE Department. Our research activities include additive manufacturing (AM), laser-based micro/nano manufacturing, 3D/inkjet printing, renewable energy manufacturing, and nontraditional machining. A new advanced laser materials processing lab will be established in the IMSE department next year to add a metal AM capability. We have successfully completed several research projects in recent years and there are several on-going projects being conducted. These projects are funded by NSF, DOE, NASA, and industry. A few examples of these projects are described below.

- *Laser assisted laminated object additive manufacturing of reinforced carbon-carbon composites.* This project is in collaboration with NASA Ames Research Center and Spirit AeroSystems in Kansas to develop an AM process for cost-effective production of high-quality carbon fiber composites for crew vehicle and aerospace applications. This study seeks to understand the mechanisms involved in the various processing steps (e.g. laser bonding, curing, and pyrolysis). The microstructure and properties of the manufactured reinforced carbon-carbon composites will be characterized.
- *Additive manufacturing of metals for energy applications.* For the energy sector, there is an emerging interest in using AM to fabricate customized components for enhancing the efficiency and overall manufacturability of modular (very small) nuclear power plants. This project focuses on studying how to best use laser-powder bed fusion AM methods for generating radiation resistant channel/pore-embedded structures from nickel-based superalloys for very small modular reactor heat exchangers. The objective is to better understand how neutron irradiation affects the microstructure and properties of additively-manufactured nickel-based superalloys, in order to accelerate their safe, reliable use in the modular reactor industry. AM is an

enabler for realizing this new wave of heat exchangers — providing a means to make customizable hot and cold stream architectures with novel flow path geometries and reduced layer-to-layer contact resistance.

- *High-performance laser scribing of advanced thin-film materials.* Thin-film materials have broad applications in the areas of electronics, light sources, renewable energy, sensors, mechanical systems and more. This project focuses on studying how a laser beam can be used to selectively remove a thin film in a multilayer structure. The project will advance a fundamental understanding of laser-matter interaction with advanced thin-film materials. The scientific knowledge will enable the development of high-performance, laser-scribing techniques that have applications in numerous areas including scribing of solar cells and smart window glass, patterning of flexible electronics, etc.

Relevance

The well-equipped advanced manufacturing labs in the Carl R. Ice College of Engineering and the J.R. MacDonald lab in the Physics Department at K-State provides the state-of-the-art facility for conducting cutting edge manufacturing research. We strive to become a leader in applying AM and laser based manufacturing to the following areas: (1) aerospace, which is relevant to the aerospace companies in Wichita, Kansas, (2) nuclear and renewable energy, which complements the unique nuclear reactor facility and faculty at K-State, and (3) health care (human and animals; many advanced manufacturing faculty are engaging the College of Veterinary Medicine for this effort) and global food systems, which are two university strategic areas.

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Innovation in High Performance Building Envelopes Collaborative Research Program

Background

Buildings consume a staggering amount of energy in the US: nearly 40% of all energy consumed, more energy than that used by either transportation or industry. Building energy costs also have a significant economic impact for businesses, whose utilities can be around 20% of operating expenses, and for households, whose utilities can be around 10% of expenditures (Source: EIA). Designing future buildings to conserve energy is crucial to the sustainability of our society, economy, and environment.

The International Energy Administration estimates that 40% of future energy reductions can be made by improving the performance of building envelopes: the walls, windows, roofs, and foundations of buildings (Source: Technology Roadmap: Energy Efficient Building Envelopes - 2013). High performance building envelopes reduce heating, cooling, and lighting energy in buildings by reducing unwanted energy flow through the building skin, while making daylight available to offset electrical lighting use. Due to the inherent nature and complexity of the problem, identifying and solving real-world problems in buildings is in greater demand than laboratory research.

Description

During the last five years at Kansas State University, a collaborative research program in the area of high performance building envelopes has brought together experts in building science with professional architects, engineers, and manufacturers to explore real-world performance challenges in building envelopes.



Research teams, composed of graduate students, use the College of Architecture, Planning, and Design's state-of-the-art fabrication facilities, laboratory resources, and computing capabilities to both build and test how high performance building envelopes enhance building performance.

Ongoing research has expanded to two major projects. In academic year 2019-20, students and faculty partnered with a non-profit County Economic Development Corporation (Stafford Co. Ecodevo) to research, design, and build an affordable, net-zero prototype home. The second project, funded through the Department of Energy's Solar Decathlon program, will realize a home prototype in Kansas City with a companion structure that will be exhibited on the National Mall in Washington, D.C., in the summer of 2020. These projects demonstrate an approach to affordable, high-performance housing that can be readily duplicated to address affordable housing concerns in urban and rural Kansas.



Relevance

Building better performing buildings and upgrading existing buildings is critical to sustaining future prosperity and growth in our communities and cities. Knowledge of building envelopes is an important asset for future professionals, and the dialogue around emerging design and analysis methods offers an incentive for professionals and manufacturers to work together to ensure improved building performance. Lastly, this project intends to support the state economy by benefitting Kansas professionals, manufacturers, and organizations who collaborate in the project.

Relevant legislation includes:

- H.R.1315 Blue Collar to Green Collar Jobs Development Act
- H.R. 2088 Reauthorization of the Energy Efficiency and Conservation Block Grant Program

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Large-Scale Integration of Clean Technologies in the Power Grid

Background

Increased global demand for energy and dwindling fossil fuel reserves are causing concern regarding global warming, climate change, and sustainability. This has resulted in worldwide interest in clean energy technologies such as wind and solar energy, and electric vehicles. Total worldwide wind power capacity has increased from 74 gigawatts (GW) in 2006 to 487 GW in 2016; the United States' share of wind power capacity surpassed 80 GW in 2016. Similarly, solar energy capacity in the United States increased from less than 1 MW in 2000 to more than 40 GW in 2016; 14.8 GW of this capacity was installed in 2016. Regarding consumption of electricity, more than 100,000 electric vehicles have been sold in the United States since 2013. Despite many benefits of clean energy, integration of these systems into the power grid can lead to a new set of technical challenges such as power plant scheduling to accommodate fluctuating wind and solar power, mitigating power quality issues due to increased usage of power electronics converters, reducing maintenance costs while providing high reliability and availability of wind turbines, and integrating high levels of rooftop solar photovoltaic (PV) generation and electric vehicles.

Government and industry have funded several research projects at Kansas State University (K-State), making K-State a leader in power engineering research and education in Kansas. The proposed research aims to leverage prior research and strength in power systems and cyber-physical systems to seek innovative solutions for an increasing penetration of clean technologies into the power grid.

Description

Objectives of the proposed multidisciplinary research include removing barriers and developing human capital through education to advance sustainable energy pathways associated with electricity generation and its use in transportation, while utilizing synergy between clean electricity generation and consumption. Faculty, students, industrial companies, and government agencies will collaborate for successful commercialization.

The research will investigate enhancement of wind-turbine efficiency and durability, energy forecasting, integrated planning, reconfigurable grid-interactive converters, and integration of advanced cyber and communication technologies for optimized operation of the cyber-physical system with a high penetration of renewable resources. Increased efficiency and long-term reliability are crucial in order for wind turbines to compete directly with natural gas. Accurate forecasting will allow improved characterization of the stochastic nature of renewable resources, leading to more efficient planning and operation of the electric

power grid. The investigation will allow opportunities to build models and tools that will facilitate more effective utilization of existing renewable resources, and integration of a significantly larger amount of additional renewable generation into the power grid.

The research will include solid-state converters, considered enabling technology, to realize a wide range of critical technologies such as grid-tied wind and solar energy systems, and electric hybrid vehicles. These converters can significantly enhance flexibility and controllability of the power grid, consequently transferring the existing energy infrastructure to the next generation with a massive deployment of clean technologies.

Research related to power-distribution networks will focus on large-scale integration of solar rooftop generation and electric vehicles with on-site storage. Life-cycle analysis will consider air quality and climate change impacts using the triple bottom line of social, environmental, and economic concerns. Public education will increase understanding of the benefits of electric cars, and wind and solar energy. The requested amount for the project is \$4,000,000 to be used by K-State for research, education, and outreach. Some of the funding will be used for installation of solar PV generation, which will be fully instrumented and connected to the Smart Grid Laboratory at K-State, for real-time data collection and analysis.

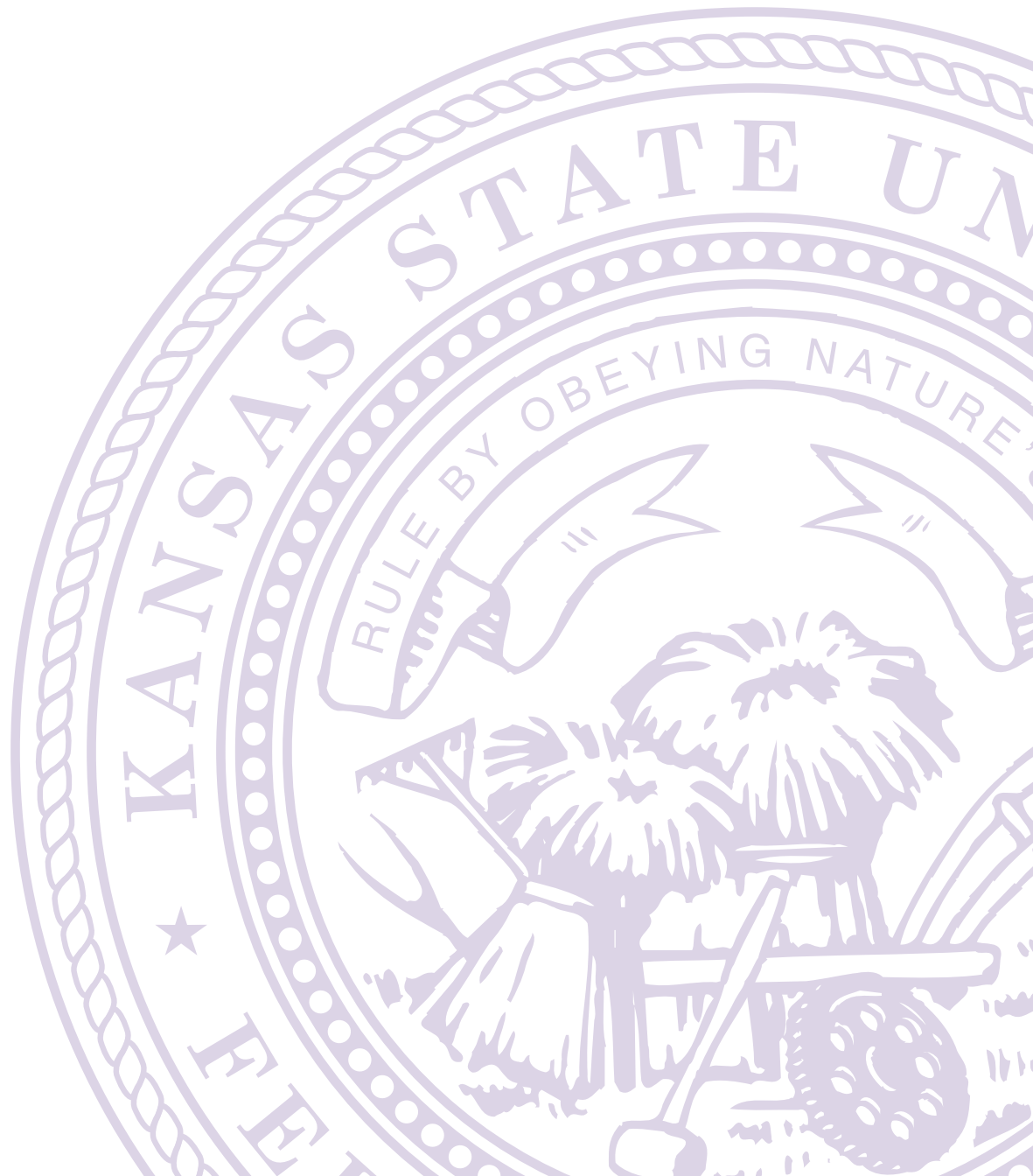
Relevance

In order to reduce dependence on foreign oil and reduce carbon emissions, and promote economic prosperity, clean energy technologies must be a top priority of the U.S. government. Clean energy not only combats climate change, but creates new opportunities for jobs and business. The proposed research is focused on maintaining the world leadership of the United States in research and education related to clean energy generation, and utilizing and advancing the K-State 2025 strategic plan.

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HOMELAND SECURITY



Integrated Solutions for U.S. Bio/Agrodefense: National Agricultural Biosecurity Center

Background

Protecting American agriculture and food from global biothreats, while safeguarding the public from zoonotic animal diseases and food borne pathogens, has been recognized as being vital to U.S. homeland security. The Homeland Security Presidential Directive-9 (HSPD-9), issued on Jan. 30, 2004, identifies six areas as critical for this mission. These are 1) awareness and warning; 2) vulnerability assessments; 3) mitigation strategies; 4) response planning and recovery; 5) outreach and professional development; and 6) research and development.

Subsequent law and guidance have codified the mandates of HSPD-9 (Public Law 115-43 in 2017 and National Security Presidential Memorandum-14 in 2018).

Description

Kansas State University's National Agricultural Biosecurity Center (NABC) is an important contributor to the activities specified by HSPD-9. This has been recognized by the Food, Agriculture, and Veterinary Resilience (FAVR) group at the Department of Homeland Security (DHS-CWMD), which has tasked NABC with defining today's bio/agrodefense capabilities. NABC will add expertise in the agriculture and food domains to the Intelligence Community by analyzing gaps and developing intelligence information requirements needed for awareness of risks and threats to the U.S. agricultural enterprise. Also, NABC will continue to build a national-level picture, county by county, of both vulnerabilities and capabilities of the U.S. to respond to a catastrophic incident impacting the food and agricultural sector.

NABC's resident expertise in response planning, training and exercising for high consequence disease outbreaks has been tapped by USDA to test capabilities locally, regionally and nationally. NABC will conduct an exercise in the High Plains region to test the region's capabilities to provide business continuity through intra- and interstate livestock movement permits. NABC will also conduct, on behalf of USDA, regional exercises at the state level to test local jurisdictions' abilities to execute their response plans.

NABC is expanding its mission area to include community resilience by creating a multidisciplinary program that includes the wide-ranging economic effects of high consequence animal disease outbreaks to encourage planning for business continuity and recovery. This area includes analysis of and response planning for agricultural inputs, i.e. feed ingredients and feed mills, and external activities like livestock exhibitions.

Relevance

America is unprepared for a high consequence disease outbreak targeting agriculture and/or food. Interruptions to the food supply, whether naturally occurring or manmade, destabilize public health and the economy. Unintentional disease outbreaks in recent years, including avian influenza and porcine epidemic diarrhea virus, have demonstrated this.

Greatly improved awareness and warning, vulnerability assessments, and response planning and recovery are needed. NABC is poised to play an important role in these efforts. Specifically:

1. Supporting efforts to reduce the economic and physical vulnerability of the livestock and food systems supply chain by emphasizing the National Livestock Readiness Program and analysis of permit networks.
2. Assessing readiness and developing capability of state and local jurisdictions to effectively respond to biological incidents, with an emphasis on response training and exercise activities.
3. Promoting the collaborative efforts of the agricultural enterprise to prepare for and respond to current and future disease threats, with an emphasis on NIFA tactical sciences network.

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EPICENTER: Laboratory for a Network Science Approach to Predict and Control the Spread of Infectious Diseases; within the Network Science and Engineering (NetSE) group

Background

Few events disrupt society and cause economic loss as severely as an out-of-control infectious disease. Terrorist activities or natural causes can produce an epidemic that may result in human deaths, disposal of herds, and destruction of crops. Fundamental to EPICENTER's mission is the conviction that epidemic dynamics and intervention strategies must be derived, while accounting for underlying complex networks that describe multiple and dynamic interconnections among involved systems.

Description

EPICENTER, a laboratory within Kansas State University's Carl R. Ice College of Engineering, provides resources to build, analyze, and simulate data-driven computational models for biomedical and biological systems represented as complex networks. Research at EPICENTER challenges scientific boundaries by addressing the impact of heterogeneity, interdependence, and stratification of networks in spreading processes. These three characteristics abound in natural and manmade infrastructures and networks, but fundamental questions remain unanswered regarding interconnected and stratified/multilayer networks.

EPICENTER has successfully conducted several research projects since its inception in 2007. Current projects include the following:

- *Predictive models of infectious diseases.* This project aims to develop innovative, multiscale computational models and tools to describe potential transmission cycles of zoonotic pathogens that could be introduced into the United States. Data generated by these models will be used to produce an operationally relevant predictive model that estimates the timing and spatial extent of emerging disease, and the transmission risk to humans. Studied diseases include Ebola, Rift Valley fever, and Japanese encephalitis.
- *Spreading processes over multilayer and interconnected networks.* The research goal of this project is to establish mathematical tools and techniques to understand the role of multilayer and interconnected topologies in spreading processes. For example, a multilayer network is a physical contact network in which a disease can propagate among individuals and an online information-dissemination network in which information can propagate among those same individuals. In zoonotic diseases, interconnected networks include the network of animals and the network of humans in which a virus can transfer from one population (network) to another.

- *Integrated models of disease spread, supply chain logistics, and communication networks.* The objective of this project is to develop integrated models that capture interdependencies among disease dynamics, supply chain logistics, and communication networks. For example, the spread of disease is influenced by the movement of animals, plants, and food products through the supply chain. Effective management of this movement and deployment of countermeasures, such as vaccines, require effective risk and crisis communication plans that engage multiple stakeholders. Stakeholders also constitute a network through which information is transmitted. The integrated modeling approach is expected to yield new insight to prevent, mitigate, and respond to infectious disease outbreaks.

Relevance

The National Agricultural Biosecurity Center (NABC), Institute for Computational Comparative Medicine (ICCM), Center of Excellence for Emerging and Zoonotic Animal Diseases (DHS CEEZAD), the planned National Bio and Agro-Defense Facility (DHS NBAF), and EPICENTER are all located in Manhattan, Kansas, thus making Kansas the national leader in developing countermeasures to naturally occurring and intentionally introduced plant, animal, human, and zoonotic diseases.

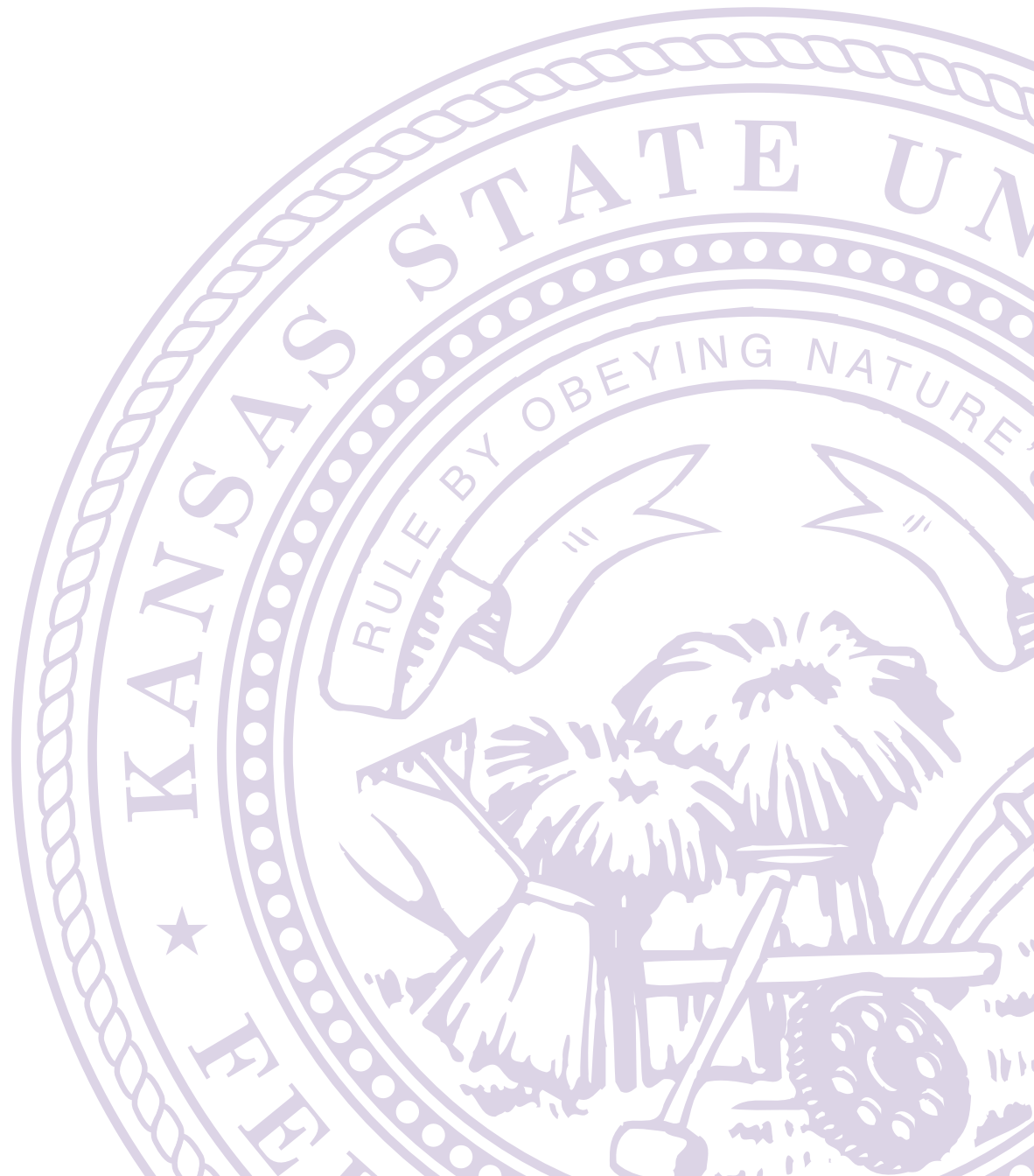
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LABOR, HHS, EDUCATION



Fundamental Cancer Research

Background

Cancer is the second leading cause of death in the United States. Around 600,000 people die from cancer each year; approximately 22% of all deaths. Congress established the National Cancer Institute (NCI) in 1937 and expanded it in 1971, giving broad powers to establish centers to do research and treat patients.

In 1978, Drs. Richard Consigli and Terry Johnson envisioned KSU's participation in the cancer fight by establishing the Center for Basic Cancer Research at Kansas State University. The Center is now responsible for close to one-half million dollars in expenditures directed at research and education at Kansas State University. This effort represents approximately 5% of the private research donations given to KSU in a given year.

To grow the Center, we have recently initiated our Center of Excellence Grants to build the foundation for a more comprehensive cancer research program and more PO-1-type projects.

Recently, we awarded our first Center of Excellence Grant, focused on fundamental research surrounding Pancreatic Cancer. The center has three areas of focus: cancer detection, drug discovery and studies involving in-vivo techniques and magnetic resonance imaging.

Description

The Johnson Cancer Research Center (JCRC)

VISION: is that it will take a leading role in conquering cancers in our time.

MISSION: Further the understanding of cancers by funding cancer research and supporting higher education, training and public outreach.

GOALS:

- Improve cancer-related research and education
- Provide scholarships and fellowships
- Enrich the student experience
- Educate citizens about cancer and cancer research

The Johnson Cancer Research Center has a variety of awards (grants, stipends and scholarships) to advance cancer research and education of KSU faculty and students. The awards are funded by private donations of both cash gifts and endowed funds. Faculty and students apply for awards in the fall and spring semesters. A review committee selects the most promising research applications for funding after extramural, peer review by cancer experts at other research institutions. In addition to funding research and training, the center has a variety of outreach programs to inform the public about cancer and cancer research at K-State.

Relevance

Funding Mechanisms for Faculty:

- Innovative research grants provide research assistance for new faculty establishing research programs, and veteran faculty exploring new frontiers.
- Equipment grants are available to research cores to purchase new equipment to remain competitive and to offer technical expertise to KSU researchers.
- Faculty travel fellowships are awarded to faculty to allow collaboration with other institutions, receive training on new research techniques, and travel to scientific conferences.
- Center of excellence grants encourage and develop interdisciplinary research programs focused on specific cancer research problems.

Student education & training programs:

- Cancer Research Awards to encourage undergraduate involvement in laboratory research.
- Summer stipends support graduate student research when other assistance is not available.
- Travel fellowships provide the opportunity for graduate students to present research and network at professional meetings.

Public outreach:

- Presentations about cancer, risk reduction and research
- Collaborations with community groups to educate public about cancer
- Events & activities to raise awareness about cancer and cancer research at K-State

Website: <http://cancer.k-state.edu/>

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Overcoming the Healthcare Shortage: Pioneering a Physician Assistant Program that Focuses on the Underserved

Background

According to the Kansas Department of Health and Environment, as of March 2018, <89% of all counties in Kansas were designated as Primary Care Health Professional Shortage areas. By 2030, the need for primary care physicians in Kansas will increase by 13% with rural areas hit the hardest. There is a definite need for more physician assistants to fill this critical healthcare gap, particularly in underserved areas. Currently, there is only one physician assistant program within the state of Kansas. This program accepts only 48 students each year with a 20:1 application to acceptance rate. With the Kansas Department of Labor projecting a 23% growth of this profession by 2026, the additional 44 physician assistants our new program will produce when it is fully implemented will address this growing need. By pioneering a program that focuses on the underserved, our goal is to design a dynamic program that incites a passion in our students to pursue a primary care job in rural Kansas.

Description

Kansas State University is developing a Physician Assistant Program that emphasizes rural medicine and the importance of service. Our physician assistant students are required to have two family medicine rotations during their clinical year of which at least one will be in an underserved area. In addition, unlike most Physician Assistant Programs, our students will have a mandatory orthopedic clinical rotation further bolstering an experience that prepares students for the type of musculoskeletal injuries and problems found in rural communities where referrals are limited. Our program will also emphasize the need to care for an aging population with a required Geriatric rotation, which is of particular relevance to rural healthcare as traveling to an urban area for a doctor's appointment is more challenging for our senior citizens. Furthermore, throughout the academic year, students will be participating in service projects, such as volunteering at area community health clinics, health fairs, and various cancer/health screening awareness initiatives. Our program will also have a robust collaboration with the Irwin Army Community Hospital's physician assistant program in joint simulation exercises and academic seminars.

Relevance

With our growing and aging population, the Association of American Medical Colleges estimates that physician demand will grow much faster than supply, with up to 121,300 new physicians needed by 2030. The Bureau of Labor and Statistics projects physician assistant job growth of 37% between 2016 and 2026. This rapid growth is secondary to physician shortages, the growing need for primary care providers, and the expansion of procedures that physician assistants are credentialed to perform.

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Education Leadership in K-12 Schools and Higher Education

Background

In an era dominated by higher standards and greater accountability for America's schools, the Kansas State University response is to prepare great leaders at all levels who know how to implement change. The College of Education (COE) at K-State is utilizing partnerships for educational leadership development that will have wide and lasting impact in Kansas and across the nation. The programs and the activities in the college are led by its Department of Educational Leadership, which includes preparation of K-12 school leaders as well as faculty who specialize in adult education. This group uses a partnership model for collaborating with schools and other educational organizations to provide leadership training that touches the lives of thousands of learners and hundreds of schools. The COE believes that partnering for a new generation of leaders produces better results by focusing on the different leadership needs associated with various community and school contexts. This foundational premise accounts for the success of current programs and informs the design of future programs.

Description

The COE at K-State is creating models and implementing educational and professional development activities to increase the number and quality of educational leaders in Kansas schools at all levels. These include:

- Educational Leadership Academies in Dodge City, Garden City, Junction City, Manhattan, Salina, Topeka, and other large school districts working with economically and socially diverse populations have provided graduate education and leadership development opportunities for school principals across the state. K-State's academies have operated since 1987 and have drawn national praise, having prepared over 500 school leaders at principal and superintendent levels.
- The Department of Educational Leadership has created a partnership with the Osage Nation of Oklahoma. This partnership has been built around the development of an Osage Nation Educational Leadership Academy (ONELA). This academy is an adaptation of K-State's model, modified to meet the place-based learning needs of its participants. The focus of the academy is to build capacity of the Osage Nation to enact its sovereign rights to be involved in the education of its own people.
- The Kansas Educational Leadership Institute (KELI) emerged from collaborative planning by five major Kansas professional entities interested in developing and supporting leadership for Kansas schools and districts in the 21st century. KELI supports first-year Kansas superintendents and recently expanded to include school

principals and special education directors. These licensed leaders participate in seminars, a mentoring program, leadership coaching, and academic work. The KELI mission and model are unique in the country.

- The John Roueche Center for Community College Leadership has a new home in K-State's COE. The Roueche Center is the nation's premiere doctoral program for aspiring community college leaders and K-State is now at the forefront of preparing this audience – both online and on campus - for the future.
- The COE has a long history of collaboration to provide educational leadership opportunities at Fort Leavenworth with the Command and General Staff College (CGSC). The Adult Education Program has awarded nearly 1,000 graduate degrees in a cohort master's program to officers at the CGSC during its nearly three-decade history. The program also awarded 12 doctorates to faculty and faculty developers at CGSC.
- K-State faculty, graduated students, and school partners are collaborating on research that demonstrates the efficacy of the university's leadership models and programs. More funding is being sought to provide support for the extensive and rigorous research and evaluation that is needed to promote the K-State model into a nationally recognized and adopted exemplary practice.

Relevance

The College's mission to prepare successful educational leaders is integrally tied to the overarching purpose of the land grant institution. We have the expertise to expand our partnerships, replicate our models and extend research to develop the educational leaders needed in K-12 settings, higher education and other organizations with a focus on teaching and learning.

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Preparing Educators: Research and Learning

Background

The COE's responsibility, as part of one of the oldest and strongest land-grant universities in the nation, is providing quality instruction and clinical supervision in both on-campus and field-based settings. Our major goal—developing educators who are knowledgeable, ethical, caring decision makers—is intertwined throughout our undergraduate program and is the basis for our national accreditation by the National Council for Accreditation of Teacher Education. To meet this goal, students are prepared as educators to appreciate differing viewpoints, consider new and divergent thinking, weigh ideas carefully, evaluate conventional wisdom, and obtain accurate and useful knowledge.

For over 25 years, K-State has utilized a Professional Development School Network with local school districts. These Professional Development Schools strengthen practical field experiences, playing a critical role in the professionalization of teaching by integrating theory from professional studies with practice in clinical settings.

Description

The COE has the capacity and commitment to recruit, prepare, and support K-12 teachers through initiatives

like the following:

- A special emphasis is on science and math teachers, and the college's current NSF-funded program provides NOYCE fellowships for individuals with math or science degrees to become teachers. The COE also has in place a cooperative dual degree for those interested in concurrent math or science education degrees.
- COE, in partnership with the Kansas Department of Education, received a Troops to Teachers-Kansas grant to support transitioning service members and veterans interested in becoming teachers. The program includes a job placement mentorship, various resources and an online virtual job fair that will connect graduates with underserved school districts in Kansas.
- Master of Arts in Teaching (MAT) program is designed as an innovative pathway to teaching for those who have previously earned a Bachelor's degree and meet other admission criteria. This pathway enables qualified students to earn the MAT and recommendation for Kansas initial teacher license in 12 months through a rigorous online curriculum. MAT pathways include Elementary, K-6; Modern Languages, K-12; and Social Studies, 6-12; and a non-licensure international track.

- COE received a US Department of Education Teacher Quality Partnership grant to provide a pathway for students in two urban and rural districts to become teachers and intend to remain in their home community. At scale, this model could serve additional place bound students and help districts grow their own teachers.
- COE's Rural Education Center (REC) focuses on meeting the needs of rural schools in Kansas and regionally. The REC recently received funding for the Teaching Rural Students STEM through Tele-Presence (TRSST) project through the Distance Learning and Telemedicine Grant Program (DLT) from USDA. The TRSST project will utilize grant funding to acquire the tele-presence equipment necessary to support STEM education learning experiences at rural schools. The REC will serve as the hub site and provide training, curriculum, instructors, and resources apart from the grant to support STEM education in our partner rural schools.
- Annually, the COE hosts the Kansas Retention Summit to bring together members of the Kansas Board of Regents, Kansas State Board of Education, Kansas Association of School Boards, elected officials and school administrators to address the most critical issue facing the profession: teacher retention.

Relevance

The College's mission to prepare successful educators is integrally tied to the overarching purpose of the land grant institution. We have the expertise to expand our partnerships and increase research, education and service to communities throughout the state and region. With a focus on rural and underserved students, K-State has the ability to impact districts and educators across the country.

Agency Contact Information

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Military-Connected Learners: Research & Teaching

Background

The College of Education (COE) at Kansas State University is committed to a military/veteran focus as part of our work. The needs and strengths of military personnel, veterans and their families have been systematically addressed by the faculty of the COE, who educate teachers, principals, superintendents, adult educators, school counselors, special educators, postsecondary advisors, and college student personnel support staff.

Description

The college's award-winning military initiative is a collegewide program that has been in place for several years. The focus of the initiative is military-connected learners at all education levels, recognizing especially that veterans in college face challenges in adjusting to a university culture that differs greatly from the highly structured military culture. Therefore, this college is designing programs and conducting research related to military-connected learners.

- The college, in partnership with the Kansas State Department of Education, was awarded a Troops to Teachers grant to establish a robust system to recruit, train, and hire military veterans and dependents for Kansas classrooms.
- The college became one of the first 100 universities to join Operation Educate the Educators, a nationwide Joining Forces initiative that was given guiding principles set forth by the American Association of Colleges for Teacher Education and the Military Child Educational Coalition.
- The school counseling program has developed a Certificate of Competence in Counseling Military-Connected Students for school counselors and candidates in counselor education graduate programs based on the theoretical and research framework and best practices in parent/family counseling and education strategies and interventions.
- The Military Child Education Coalition awarded the College of Education the 2014 LTG (Ret.) H.G. "Pete" Taylor Higher Education Partnership of Excellence award in recognition of our work with school partners in educating military-connected students.
- A faculty-developed leadership training program, the Brigade Command Team Spouse Development Program, was awarded the Malcolm Knowles Award for Outstanding Program in Adult Education in 2010.
- The college produced a widely disseminated documentary, "A Walk in My Shoes: Military Life" (<https://coe.ksu.edu/walk-in-my-shoes/military-life.html>), in which seven people currently connected to the College of Education — retired soldiers, spouses, a child and educators — share their

perspectives on the rewards and challenges of being connected to the military. Topics include the realities of deployments for the family and the soldier, post-traumatic stress disorder (PTSD), and the social/emotional needs of military-connected students.

- Our adult education graduate program is active at Fort Leavenworth and has awarded nearly 1,000 graduate degrees at the Command and General Staff College in the past 25 years. The Security Studies program in the College of Arts and Sciences expands these efforts by offering interdisciplinary M.A. and Ph.D. degrees, that combine History and Political Science, for students interested in national security, world politics, transnational problems and international affairs.
- Faculty and graduate students conduct research related to timely topics in education. Several recent dissertations have addressed military and veterans' issues, such as the impact of deployment on school behavior, creativity and cognitive development in military courses, effects of stress in the military classroom, military faculty self-efficacy, and faculty development at military colleges.

Relevance

The College of Education is making a significant contribution to the education of military-connected students and veterans and is impacting the education of our undergraduate and graduate students in their knowledge of and appropriate pedagogy and practice for veterans, members of the military and their families. Building on this work and expanding partnerships will position our program for additional research opportunities that can further help educators better understand the needs of military-connected students.

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Precise Image-guided Interventions for Cancer Treatment

Background

Cancer is the leading cause of mortality in the US after cardiovascular disease. Technical advances in cross-sectional imaging have driven the development of localized cancer interventions delivered under medical imaging. In contrast to the three established pillars of cancer care – surgery, ionizing radiation, and chemotherapy – localized, image-guided interventions are considerably less invasive and have substantially reduced systemic toxicity. They may offer a therapeutic option for the elderly and other patients not candidates for conventional surgery, and offer potential to be delivered in an outpatient setting at considerably reduced costs. Imaging-guided thermal ablation is one such localized intervention that is increasingly being used. Thermal ablation has been shown to prolong survival in patients with hepatocellular carcinoma, and maintain quality of life of patients with painful bone metastases. Mild heating at sub-ablative temperatures offers the potential for modulating physical and physiological barriers to drug delivery, and synergizing with other therapeutic modalities. Our interdisciplinary group is developing technologies for precise and personalized delivery of thermal therapies, and methods for monitoring and assessing treatment efficacy.

Description

Imaging-guided thermal interventions employ devices for the targeted delivery of non-ionizing energy (electromagnetic, laser, ultrasound) within the body, where it is converted to heat. Intense heating leads to direct tissue destruction and may be used as a stand-alone therapy (thermal ablation). Mild heating at sub-ablative temperatures, while not destroying tissue outright, facilitate enhanced delivery of therapeutics and may act synergistically with other modalities.

Our interdisciplinary team, consisting of investigators from the Carl R. Ice College of Engineering (Electrical and Computer Engineering), Veterinary Medicine (Clinical Sciences; Diagnostic Medicine/Pathobiology), and Arts & Sciences (Chemistry) at Kansas State University, is developing and evaluating technologies for precise and personalized delivery of image-guided thermal therapy. We have developed microwave devices and systems offering 3D spatial control of thermal therapy profiles that can be delivered to diverse targets within the body via percutaneous, endoscopic, or endocavity approaches. We are investigating application of

these devices for treating malignant and benign tumors in the lung, liver, pancreas, and adrenal gland, and are conducting pre-clinical in vivo technology evaluation in large animals. We are also developing patient-specific computational models, informed by pre-procedural imaging, incorporating means for assessing uncertainty in treatment outcome based on the inherent variability in tissue biophysical properties. To drive detailed investigations of mild-heating in small-animal disease models, we have developed a system for delivering mild hyperthermia to tumor targets in experimental small-animals integrated with ultra-high field 14.1 T MRI. Finally, we are developing multi-scale computational models to identify thermal therapy parameters that optimally enhance tumor – immune system interactions.

In summary, our interdisciplinary team is uniquely positioned to develop technologies for personalized delivery of minimally-invasive imaging-guided thermal interventions for cancer treatment and to evaluate their performance in large animals and small-animal disease models. The multi-scale modeling tools we are developing have potential to identify conditions when thermal interventions optimally synergize with other therapeutic modalities.

Relevance

Development of the technologies described here will lead to the development of practical devices and systems for delivering thermal therapy, as well as provide researchers across the nation with predictive tools to assess the impact of adding thermal therapy to other cancer treatment modalities. This should accelerate the development of multi-modality treatments and their translation to clinical investigation. Biomedical systems is a departmental priority area for Electrical and Computer Engineering. Undergraduate and graduate students participating in this project will learn how to conduct research in interdisciplinary teams, which are increasingly important for solving some of society's most challenging problems.

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Priority Zoonotic Animal Drugs

Background

Essentially all human pandemic threats today and the majority of human infectious diseases are zoonotic animal diseases, i.e., animals carry diseases that can be transmitted to people. Surprisingly, there has been little focus on developing vaccines and other counter-measures designed to stop these diseases in the animal host before they threaten human health.

The Pandemic and All-Hazards Preparedness and Advancing Innovation Act was enacted in 2019. The U.S. Senate version of the bill had included a section to address zoonotic diseases in the animal host (Section 512A, Priority Zoonotic Animal Drugs), but it was not in the final bill enacted. As a result, Congress has been considering stand-alone legislation to remedy the problem.

Description

Section 512A, Priority Zoonotic Animal Drugs, was to: “expedite the development and review of such new animal drug if preliminary clinical evidence indicates that the new animal drug, alone or in combination with 1 or more other animal drugs, has the potential to prevent or treat a zoonotic disease in animals, including a vector borne-disease, that has the potential to cause serious adverse health consequences for, or serious or life-threatening diseases in, humans.” Presumably, a stand-alone bill would be designed to do the same.

K-State has extensive experience in developing animal disease detection technologies, vaccines, and other countermeasures, including many for priority zoonotic diseases. The Biosecurity Research Institute (BRI) at Pat Roberts Hall (PRH) has allowed K-State scientists to jump-start research on pathogens designated to be worked on in the National Bio and Agro-defense Facility (NBAF) which is in the final stages of construction next to the BRI. That has included the zoonotic diseases Rift Valley fever (RVF) and Japanese encephalitis (JE) as well as the non-zoonotic diseases African swine fever (ASF) and classical swine fever (CSF).

To date, there have been 75 research publications on this NBAF-related work, including 27 on RVF and 8 on JE since 2013. No other university has published more on priority zoonotic diseases or is better prepared to generate priority zoonotic animal drugs than K-State.

Relevance

The purpose of Section 512A, Priority Zoonotic Animal Drugs, was to expedite the development and review of new animal drugs and doing so would have included, as appropriate —

- (i) taking steps to ensure that the design of clinical trials is as efficient as practicable, when scientifically appropriate, such as by utilizing novel trial designs or drug development tools (including biomarkers) that may reduce the number of animals needed for studies;
- (ii) providing timely advice to, and interactive communication with, the sponsor (which may include meetings with the sponsor and review team) regarding the development of the new animal drug to ensure that the development program to gather the nonclinical and clinical data necessary for approval is as efficient as practicable;
- (iii) involving senior managers and review staff with experience in zoonotic or vector-borne disease to facilitate collaborative, cross-disciplinary review, including, as appropriate, across agency centers; and
- (iii) implementing other administrative or process enhancements, as necessary, to facilitate an efficient review and development program.

As already noted, K-State has extensive experience in developing animal disease detection technologies, vaccines, and other countermeasures, including many for priority zoonotic diseases. In addition, the BRI/PRH provides unique biocontainment infrastructure that few, if any, other universities can match. Thus, K-State is positioned to lead the nation in the development of priority zoonotic animal drugs. Specifically, at the BRI we are researching —

- Diagnostics and Vaccines: preparedness and countermeasures to respond and combat high consequence pathogens including potential bioweapons.
- New arthropod-borne disease threats to the U.S. including workforce education and training.
- Collaborative research on high consequence pathogens with the USDA.

To protect America, Congress should formulate and pass a stand-alone Priority Zoonotic Animal Drug bill.

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Research & Development for U.S. Bio/Agrodefense: Protecting Agriculture and Preserving Public Health

Background

There is increasing awareness of the risks posed to U.S. agriculture and public health due to processes such as 1) the accidental or deliberate introduction of disease agents previously confined to other parts of the world, 2) the emergence of hitherto unknown pathogens or 3) the acquisition of new capabilities by microbes previously considered benign.

The 2018 White House National Biodefense Strategy outlines five goals with associated objectives for strengthening the biodefense enterprise, including to “Strengthen biosafety and biosecurity practices and oversight to mitigate risks of bioincidents” and to “Ensure a vibrant and innovative national science and technology base to support biodefense.”

Description

The Kansas State University Biosecurity Research Institute (BRI) at Pat Roberts Hall is a linchpin of U.S. bio/agrodefense capabilities because of its capacity to support research and development of diagnostic tools, contribute to greater understanding of the basic biology and life cycle of poorly-understood pathogens, and provide a testing ground for possible countermeasures and treatments.

The BRI is one of a few high containment facilities in the U.S. allowing research on livestock experimentally infected with a broad range of highly pathogenic organisms. For example, the BRI is the designated facility at KSU for work on organisms classified by the U.S. government as Select Agents. These are agents that have the potential to be weaponized and require specialized facilities and highly trained personnel to ensure constant safety and security. Research at the BRI has already resulted in development and testing of two vaccines for highly pathogenic influenza, a vaccine for classical swine fever, and vaccines for Rift Valley Fever virus. These diseases are either zoonotic or potentially devastating to agriculture, or both.

Among the specialized facilities at BRI are 1) a state-of-the-art Arthropod Containment Level 3 Laboratory and supporting mosquito-rearing room that allows researchers to investigate interactions between pathogens and their insect vectors and 2) a food production research suite that supports research on pathogens entering the food production process at various points. BRI has hosted research on mosquito-borne diseases such as Japanese encephalitis and Zika as well as on deadly food-borne pathogens including Shiga-toxin-producing *Escherichia coli* and potential deliberate contaminants such as *Bacillus anthracis*.

Plant pathogens are also under study at the BRI, including known and emerging pathogens that threaten Kansas and worldwide production of three of the top five crops grown globally, namely wheat, corn, and rice. Research topics include improving our ability to predict and detect the emergence of new pathogen varieties with enhanced virulence as well as mitigation strategies for existing and novel types. One example is wheat blast, which is a newly emerged and globally spreading disease causing substantial losses in South America and Southern Asia. This disease, and others, have the potential to disrupt food security and to destabilize already weakened nations.

Relevance

America is unprepared for a bioterrorism attack targeting agriculture — crops or livestock — or food. Interruptions to the food supply, either natural or manmade, threaten public health and economies. Furthermore, a growing worldwide population, changes in land use and climate, and increased global mobility and trade all increase the likelihood of the spread of previously unknown diseases. Improvements in basic science, vulnerability assessments, and mitigation strategies are needed to address these real threats.

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Improving Mental Health and Well-being by Building Healthy Relationships and Ending Violence

Background

Healthy relationships are fundamental to individuals' overall health and well-being. In fact, individuals who have a healthy relationship:

- Live longer
- Heal faster
- Have stronger immune systems
- Have better heart health (e.g., lower blood pressure, less heart disease, reduced risk of heart attack)
- Experience less stress
- Experience lower rates of depression
- Feel better about themselves
- Are happier

Many Kansas families experience repeated transitions, prolonged stress, unstable situations, and poverty, which negatively effects relationships. Every person deserves the opportunity to have healthy relationships and to live free from the experience of interpersonal violence, toxic stress, and social immobility. Researchers, teachers, and outreach professionals in K-State's School of Family Studies and Human Services (FSHS) are dedicated to contributing to the development and enhancement of healthy relationships to improve the mental health and well-being of individuals and families.

Description

To address these issues, applied research, clinical services, and programming are underway across units in the School of FSHS to:

1. support healthy relationships across life-course transitions, cultures, family development, and in long-term relationships;
2. assess the risk markers of intimate partner violence across generations;
3. support healthy partner and/or or parenting relationships;
4. develop and test a violence risk assessment tool to guide prevention and treatment of partner violence efforts in military families;
5. assess the impact romantic relationships and parenting behaviors have on child outcomes;
6. assess the risk markers of sexual assault;
7. implement and evaluate a relationship education program for at-risk youth;

8. study communication technologies on relationships between former partners and between parents and children following divorce;
9. support and encourage parent-child communication about health and well-being;
10. develop technology to make relationship research accessible to all;
11. develop research-based community programs that focus on strengthening relationships in the context of individual family units and the communities where they reside.

Faculty in K-State's School of FSHS have received grants and contracts to support research on building healthy relationships, preventing partner violence, and supporting family resilience.

Relevance

Adults who are in healthy relationships have better physical health, fewer emotional problems, and are more financially successful. Children who grow up in homes with parents in healthy relationships also do better in all aspects of life.

Faculty in K-State's School of FSHS in the College of Health and Human Sciences are conducting applied research that support healthy relationships. They are receiving private, state, and federal funding for their research and have received national and international recognition for their efforts.

Agency Contact Information

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Administration on Children, Youth, and Families
Family and Youth Services Bureau
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Elizabeth Darling

U.S. Department of Health and Human Services
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Office of Family Assistance
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U.S. Department of Agriculture
National Institute of Food and Agriculture
Institute of Youth, Family, and Community

Office of the Under Secretary for Personnel and Readiness
Deputy Assistant Secretary of Defense for Military Community and Family Policy
Ann Thomas Johnston

Attacking Cancer with Exercise

Background

A recent large (1.4 million people) epidemiological study, funded by the National Institute of Cancer, demonstrated a significant risk-reduction for 26 major cancers in those that are physically active, with an obesity-independent risk reduction for many of these cancers. In addition, once diagnosed with cancer, patients who exercise have an increased survivability versus sedentary counterparts. This data suggests that exercise has both a preventive and therapeutic effect on cancer and cancer treatment(s), respectively. However, the effect(s) of exercise on the tumor microenvironment, as well on the cardiovascular system with traditional cancer treatments, are unknown.

Description

The Department of Kinesiology in the College of Health and Human Sciences is conducting translational research, including determining molecular mechanisms of cancer genesis, treatment outcomes in pre-clinical models through cardiovascular function in the exercising human cancer survivor. Main themes, description and departmental expertise are:

Exercise, the tumor microenvironment and outcomes with radiation therapy. Tumors contain areas of low oxygen which make them resistant to radiotherapy and more likely to metastasize, thus strategies to enhance tumor oxygenation are clinically relevant. Our data demonstrate that exercise training can greatly enhance tumor oxygenation, which would enhance patient prognosis as well as responses to radiation therapy. Dr. Brad Behnke is using exercise (real and simulated) as an intervention to impact the tumor microenvironment and potentially enhance outcomes and prognosis of cancer patients.

Long-term cardiovascular effects of cancer treatment: In cancer patients and survivors, exercise is prescribed to specifically combat the fatigue associated with cancer treatment, as well as improve depression and other psychological aspects associated with the diagnosis and treatment of cancer. Dr. Carl Ade has demonstrated that chemotherapy treatment can have long-term (10+ years) deleterious effects on the capacity of the body to increase blood flow, which would contribute to the chronic fatigue reported by cancer survivors. Drs. Carl Ade and Brad Behnke plan to assess the impact of cancer treatment on cardiovascular outcomes in human (Ade) and pre-clinical models (Behnke).

Enhanced nitric oxide signaling to improve tumor oxygenation: Cyclic hypoxia within the core of solid tumors upregulates at least 35 genes associated with enhanced tumor growth and metastasis. This cyclic hypoxia is associated with vasomotion and poor nitric oxide mediated signaling in the blood vessels perfusing tumors. Dr. David Poole has identified a role of nitrate/nitrite supplementation in human patients with heart failure as a means to enhance oxygen delivery to poorly perfused tissue. Dr. Poole is extending this original line of research to determine if nitrate supplementation can enhance nitric oxide bioavailability within tumor blood vessels to mitigate cyclic hypoxia and down-regulate pro-metastatic genes.

Cancer and reduced exercise capacity. Cancer patients universally report fatigue after diagnosis through treatment and recovery. In fact, many cancer patients ascribing fatigue as the most distressing side-effect of cancer and its treatment. This cancer-related fatigue is typically attributed to the side-effects of cancer treatment. However, Dr. Steven Copp has recently demonstrated that the disease itself, prior to diagnosis (i.e., before any tumor burden occurs), reduces the capacity to perform work and exercise. Dr. Copp is investigating mechanisms responsible for this early loss of functional capacity and whether exercise training can prevent fatigue in cancer patients prior to treatment.

Relevance

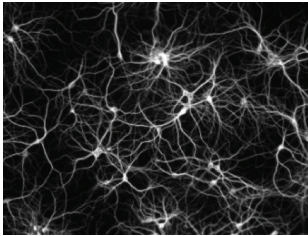
Roughly 1 in 2 people will hear the words “you have cancer” in their lifetime. It is becoming evident that many of these cancers are preventable with a healthy-lifestyle involving exercise. In addition, in cancer patients, exercise may enhance outcomes (e.g., kill fraction of the tumor) with traditional therapies (chemotherapy and radiation) and prevent cardiovascular dysfunction associated with the primary tumor as well as treatment. Faculty in the department of Kinesiology have received local and national funding (e.g., NIH, American Cancer Society) for their research endeavors and are synergistically attacking this disease using what is often referred to as aerobic exercise therapy in cancer patients.

Agency Contact Information

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Cognitive and Neurobiological Approaches to Plasticity (CNAP) Center

Background



Changes that occur in the brain as a function of growth, aging, or experience are referred to collectively as plasticity. Plasticity is essential for adaptive behaviors, and is critical for healthy functioning. CNAP researchers investigate

plasticity in humans and animal models using basic and translational research techniques. The overarching goal of this recently-funded center is to understand the mechanisms of cognitive and neural plasticity with the ultimate goal of promoting healthy functioning.

Description

The CNAP Center of Biomedical Research Excellence was funded in July of 2017 by a \$10.6 million, five-year grant from the National Institute of General Medical Sciences. CNAP is housed at Kansas State University in the Department of Psychological Sciences and is partnered with the Department of Psychology at Wichita State University. The grant will support four projects, three research cores, and three programs as well as a host of other research activities. The research cores include:

- The Behavioral Neuroscience core, housed in the K-State Department of Psychological Sciences, which has been modernized to enable the use of cutting-edge neuroscience techniques for application to animal models of disease.



- The Neuroinformatics core, housed in the K-State Engineering Complex along with the Beocat Computing cluster, which is facilitating the visualization, sharing, and analysis of large data sets.
- The Driving Simulator core, housed at Wichita State University, which will support research on plasticity and driving behavior in a state-of-the-art virtual reality immersive driving environment with integrated eye tracking capabilities.



Relevance

Research projects will occur along three themes:

- **Aging and neurodegeneration** research will connect with multi-disciplinary centers on aging at Kansas State and Wichita State Universities. The average age of the US population has been increasing significantly, and persons over 65 now represent about 15% of the population with projections of about 22% by 2040. Understanding factors that promote healthy aging (both in terms of cognitive performance and delaying disease onset) can have a major financial impact in addition to the overall impact on the well-being of the US population. Our projects related to aging are designed to understand mechanisms that impact on important everyday functioning, which is critical for maintaining an independent lifestyle.
- **Neurobiology of reward and decision** will examine neuronal plasticity of reward valuation, with links to decision making and alcohol abuse. Given the numerous disorders associated with deficient reward valuation and decision making processes, including ADHD, drug abuse, gambling, and obesity, there are rich opportunities for CNAP to make a significant impact on the field in these areas. Our projects in this area will examine factors that influence the development of alcohol abuse in adolescence/early adulthood and the neural circuits of flexible decision making.
- **Translational/comparative neuroimaging** is an area of recent growth and additional planned growth at Kansas State. With the establishment of a new small-animal imaging core in the Department of Chemistry coupled with plans to grow human neuroscience in the Department of Psychological Sciences and the collaborative use of human neuroimaging facilities at University of Kansas Medical School, we are in a position to be able to support both animal model and human neuroimaging techniques. These techniques can be implemented to answer questions relating to aging and neurodegeneration as well as work in the neurobiology of reward and decision, significantly advancing our understanding of neuronal plasticity mechanisms within these areas. Neuroimaging is an essential technique for understanding neuronal plasticity, and we aim to develop a strong focus on this area over the course of the next five years.

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**MILITARY
CONSTRUCTION,
VETERANS AFFAIRS**



Supporting Wounded Warriors

Background

One-and-a-half million Iraq and Afghanistan veterans are expected to return home in next few years bringing the number of transitioning soldiers to 2.3 million. The Iraq and Afghanistan Veterans of America group estimates that nearly 1 in 3 soldiers deployed in Iraq and Afghanistan suffer from Post-Traumatic Stress Disorder (PTSD), Traumatic Brain Injury (TBI), depression, or chronic fatigue syndrome. According to Department of Veterans Affairs, each month more than 22 Iraq and Afghanistan war (IAW) veterans commit suicide.

Since Kansas hosts three military bases (Forts Riley and Leavenworth and McConnell Air Force Base), it is estimated that more than 10,000+ veterans have returned and 15,000+ will come back to Kansas in next few years. These soldiers are looking for a meaningful way of life, despite their multiple injuries and physical limitations. As they transition into civilian life, they need healthcare, rehabilitation, and different vocational training to support themselves. Research indicates that 61% of our nation's family farms are struggling to find help as their owners reach retirement age. Average age of a farmer is nearing 60 and 40% of the farmers are over 65 years of age. We will need 1,000,000 farmers over the next several decades to replace these retiring farmers. A survey of veterans indicated that 45% of veterans are interested in farming. Various government agencies including Department of Defense, Agriculture, Veterans Affairs, and Labor desire to engage these veterans in farming to bridge this gap.

Description

Since 2010, Kansas State University's faculty and graduate students have worked with Fort Riley Military Hospital, Kansas Rehabilitation Hospital and Service-members Agricultural Vocational Education (SAVE), in understanding the wounded warriors' needs for rehabilitation, medical facility, therapy, housing, and education. This collaborative effort brought together military staff, professional architects and designers, medical experts, therapists, horticulturists, agronomists, product and furniture manufacturers, and graduate students to develop solutions to facilitate rehabilitation of wounded warriors. In last nine years, these collaborative efforts included developing prototypes for rehabilitation hospitals, rehab-housing, vocational education campus, prosthetic skin design, furniture and product designs to assist these veterans and the active service members. These research and design teams used state-of-the-art facilities and laboratory resources available within the College of Architecture, Planning & Design. The research and design methodologies have also been useful for professional applications in design, architecture, and rehabilitation settings.

Faculty have identified areas of further research and potential partners to continue to serve our veterans and service members. Some of the research areas include impact of Mindfulness and other stress reduction techniques for soldiers affected by PTSD and TBI, and development of prototypes of spaces and furniture to practice Mindfulness in their everyday lives, equipment and transportation device design to assist soldiers' movement, as well as vocational training for agriculture. Potential collaborators include military hospitals and manufacturers interested in expanding their research and development activities. The faculty seek partnerships and funding to support and expand these collaborative program's outreach and service.

Relevance

Development of mindfulness practice areas and tools is critical in saving soldiers' lives. Similarly, equipment and transportation device development will provide them opportunity to become independent, continue to serve their country, foster their personal and professional growth, and contribute in their community's future prosperity. This engaged project develops our graduate students' learning while serving the community members in need. The outcomes of these projects will be beneficial for the professional collaborators and manufacturers as well.

Relevant legislation includes

- H.R.4633 CERTIFY Heroes Act
- H.R. 2487 Wounded Warrior Workforce Enhancement Act

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Overcoming the Healthcare Shortage: Pioneering a Physician Assistant Program that Focuses on the Underserved

Background

According to the Kansas Department of Health and Environment, as of March 2018, <89% of all counties in Kansas were designated as Primary Care Health Professional Shortage areas. By 2030, the need for primary care physicians in Kansas will increase by 13% with rural areas hit the hardest. There is a definite need for more physician assistants to fill this critical healthcare gap, particularly in underserved areas. Currently, there is only one physician assistant program within the state of Kansas. This program accepts only 48 students each year with a 20:1 application to acceptance rate. With the Kansas Department of Labor projecting a 23% growth of this profession by 2026, the additional 44 physician assistants our new program will produce when it is fully implemented will address this growing need. By pioneering a program that focuses on the underserved, our goal is to design a dynamic program that incites a passion in our students to pursue a primary care job in rural Kansas.

Description

Kansas State University is developing a Physician Assistant Program that emphasizes rural medicine and the importance of service. Our physician assistant students are required to have two family medicine rotations during their clinical year of which at least one will be in an underserved area. In addition, unlike most Physician Assistant Programs, our students will have a mandatory orthopedic clinical rotation further bolstering an experience that prepares students for the type of musculoskeletal injuries and problems found in rural communities where referrals are limited. Our program will also emphasize the need to care for an aging population with a required Geriatric rotation, which is of particular relevance to rural healthcare as traveling to an urban area for a doctor's appointment is more challenging for our senior citizens. Furthermore, throughout the academic year, students will be participating in service projects, such as volunteering at area community health clinics, health fairs, and various cancer/health screening awareness initiatives. Our program will also have a robust collaboration with the Irwin Army Community Hospital's physician assistant program in joint simulation exercises and academic seminars.

Relevance

With our growing and aging population, the Association of American Medical Colleges estimates that physician demand will grow much faster than supply, with up to 121,300 new physicians needed by 2030. The Bureau of Labor and Statistics projects physician assistant job

growth of 37% between 2016 and 2026. This rapid growth is secondary to physician shortages, the growing need for primary care providers, and the expansion of procedures that physician assistants are credentialed to perform.

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TRANSPORTATION



Global Aeronautics Initiative

Background

Kansas State University Polytechnic (KSUP) is uniquely positioned to leverage opportunities for advancements in both manned and unmanned aircraft systems (UAS) to capture global leadership within key sectors of these technical areas in higher education. This effort is aimed at substantially impacting the regional and state economies through increased enrollments, leveraged innovation and resulting commercial opportunities. This intersection of technology with KSUP's experience and rapidly expanding market demand provides an extraordinary opportunity to establish K-State and Kansas as national and global leaders in this technology.

With a rich history in aviation, applied research and education, KSUP has a unique opportunity to become a community of learning and partner of choice for global companies. An innovative statewide economic growth strategy will build upon an existing set of capabilities, assets, and organizations to create a collaborative ecosystem around aeronautics that cannot be found anywhere else in the world.

Description

The focus on aeronautics includes training UAS operators and managers and future aviation industry leaders. The strategies and initiatives envisioned by K-State are focused on economic prosperity and competitiveness across the state.

This initiative also fulfills a strategic national need by contributing to national workforce development in the aviation and aerospace sectors, which are currently experiencing a historic labor and talent shortage resulting in air transportation system disruptions.

Kansas State University is poised to lead a state-wide effort to advance economic development in aviation through research, innovation, and training. Linking research and training efforts from around the state into a globally competitive coalition will enable Kansas to become the world leader for solutions to challenging problems in applied aviation.

Relevance

KSU Polytechnic partners with organizations and departments nationally to develop a targeted and intentional plan to court this industry. This is the cornerstone of a larger statewide strategy to retain global aerospace manufacturing and training dominance. To further this plan, we are seeking assistance with these major sub-initiatives:

1. **Funded FAA Partnerships.** KSUP has a strong relationship with the FAA:
 - UAS Research Center of Excellence. Kansas State serves as a core university and support for contracts ensure more capacity for KSU support to FAA research.

- **FAA UAS Test Site.** In partnership with University of Alaska's Pan-Pacific UAS Test Range Complex, an FAA-designated test site, UAS flight test operations under K-State's direction require an initial investment of \$1M and an annual sustainment budget of \$500K.
 - **FAA Integration Pilot Program.** In partnership with the Kansas Department of Transportation, KSUP set the pace for UAS integration into the NAS. As the project ends in FY20, additional support is required to promote UAS integration into the airspace.
 - **Aircraft Certification.** There is an emerging need to train world engineers in the practice of aircraft certification, the single most significant key to a safe national airspace system. Request your advocacy to convince senior FAA leadership to prioritize certification training standardization, policies and standards.
2. **UAS Public Safety Training.** Through non-credit short courses, KSUP is helping public safety agencies incorporate UAS into their operations. KSUP received a grant from the National Institute of Justice to conduct research on UAS for crime scene reconstruction. Additional funding will help promote UAS integration into public safety.
 3. **Advanced Flight Simulation Center.** New generation Flight Training Devices (FTDs) to support complex training environments for manned and unmanned flights. Advocacy needed for KS to lead the commercialization of UAS.
 4. **Talent Pipeline Development.** In partnership with NOAA, Airforce ROTC, and VA, KSUP provides professional training and a holistic perspective of the aviation industry. Advocacy for talent and workforce development initiatives and increase outreach to veterans, as well as underrepresented populations.

Agency Contact Information

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National Institute for Aviation Diversity

Background

Kansas State University Polytechnic is uniquely positioned to leverage opportunities for advancements in both manned and unmanned aerial systems to capture global leadership within key sectors of these technical areas in higher education. This effort is aimed at substantially impacting the regional and state economies through increased enrollments, leveraged innovation and resulting commercial opportunities. This intersection of technology, along with Polytechnic's experience and rapidly expanding market demand provides an extraordinary opportunity to establish K-State and the state of Kansas as national and global leaders in this technology.

With a rich history in aviation, applied research and education, KSU Polytechnic has a unique opportunity to become a community of learning and partner of choice for global companies. An innovative statewide economic growth strategy will build upon an existing set of capabilities, assets, and organizations to create a collaborative ecosystem around manned and unmanned aeronautics that cannot be found anywhere else in the world.

Description

The focus on manned and unmanned aeronautics includes training UAV system operators and managers and future aviation industry leaders. The strategies and initiatives envisioned by Kansas State University are focused not only on local impacts, but on economic prosperity and competitiveness across the state.

This initiative also fulfills a strategic national need by contributing to national workforce development in the aviation and aerospace sectors, which are currently experiencing a historic labor and talent shortage resulting in air transportation system disruptions.

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Relevance

K-State Polytechnic is working with their aviation industry advisory committee and corporate partners to create an inclusion and diversity plan specific to aviation. Kansas State University seeks to advance student success through diversity, inclusion, and social justice. This initiative focuses on fostering success among the multicultural and diverse K-State community with the goal of becoming the most inclusive and welcoming university to all students. Kansas State hosts engagement opportunities targeted at recruiting and retaining women in the aviation field including the Teen Women in Science and Technology Summit, Girls in Aviation Day, and the K-State Polytechnic aviation industry mentorship program. These programs bring together diverse groups to create a more inclusive and equitable aviation industry and prepare a diverse student body to lead in a global industry.

According to the FAA Aeronautical Center 2017 Data, women currently represent only 6% of the pilot and 2% of the maintenance workforce in aviation. Kansas State Polytechnic is dedicated to partnering with aviation organization and agencies such as the National Center for Advancement of Aviation (NCAA) and the Federal Aviation Administration (FAA) to support and engage underrepresented groups in aviation. The NCAA supports initiatives to foster a diverse and reinvigorated Aviation Workforce. In order to invest in pilot education and aviation workforce training in the United States, the NCAA works to ensure the development and sustainability of the civil and military aviation workforce via the promotion of youth aviation programs.

FAA Reauthorization Act of 2018 states that the aviation industry should explore all opportunities to encourage and support female students and aviators to pursue a career in aviation. The Workforce Development program focuses on outreach to communities underrepresented in the aviation industry and provides grant funding up to \$500,000 per year through 2023. Funding advocacy for this Workforce Development program is key to a successful future.

Agency Contact Information

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Central Archive for Transit Passenger Data (CATPAD)

Background

Across the nation and at all levels of government, there has been a resurgence of interest in public transportation. This interest stems from transit's ability to meet a number of pressing social concerns. Economic development specialists see transit as offering a key amenity to attract young knowledge-workers, lure growing businesses, ensure community resilience to fluctuations in fuel prices, reduce congestion, allow older adults to age in place, and preserve property values. Environmental advocates see transit as a means to reduce air pollution, slow greenhouse gas emissions, revitalize existing urban areas, foster alternative travel behavior (such as walking, biking and shared-use modes), and mitigate the need for costly investments in additional roadway infrastructure. Equity advocates see transit as an essential service to foster food, health care and employment access for lower-income populations as well as a critical component to meeting federal civil rights and environmental justice objectives. All of these groups are united in their concern that transit is actually achieving these goals.

One of the best means to assess and monitor transit performance is by analyzing the results of on-board surveys. Most public operators conduct such surveys already and recent civil rights guidance from the Federal Transit Administration ensures that all will need to do so in the near future. Unfortunately, despite the substantial sums of public monies required to conduct these surveys, the resulting data are surprisingly difficult to obtain. There is no single public repository for this information with the result that even within a single transit agency data are often lost over time. Furthermore, the lack of data availability hinders the work of outside researchers, auditors and public advocates to examine the success of the transit systems. System administrators are unable to easily examine the survey instruments and data from their peers to inform their own surveying efforts or compare their results.

In short, the major public investment in transit survey data creation is not being optimized. There is a demonstrated need for an institute dedicated to collecting, archiving, researching, and disseminating this information.

Description

The Central Archive for Transit Passenger Data (CATPAD) combines a secure data repository, research center and outreach program to advance transit use and transportation justice. CATPAD is in the process of developing the nation's only secure and searchable archive for transit survey data. This resource provides, for the first time, a platform for the systematic, academic inquiry of ridership across the transit services in the United States. CATPAD researchers use this resource to develop innovative approaches for exploring transit survey data. Current research evaluates transit equity, particularly in light of the federal civil rights guidance, as well as the role of transit in fostering community resilience, especially regarding older adults, people with disabilities, low-income families and rural households.

CATPAD researchers also assess and refine transit surveying techniques, which are undergoing a rapid transformation with the availability of handheld GPS-enabled data-entry technologies. CATPAD partners with public agencies and consultants to implement and test these new approaches to surveying. This activity provides an important engagement and service learning opportunity for Kansas State University faculty and students. Furthermore, this outreach is critical to CATPAD's mission of advancing the quality of transit data to advance the effectiveness of transit.

Relevance

Public agencies in the United States spend millions of dollars annually to collect transit survey data. The CATPAD is working to greatly expand the public return on those investments. The CATPAD first makes those data available and second, provides a research environment to make those data relevant. This environment incorporates undergraduate and graduate students in engaged scholarly work with high value both for academia and in professional practice.

Agency Contact Information

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