



KANSAS

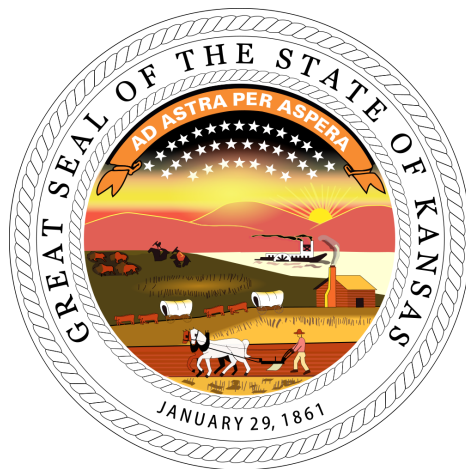
B.E.S.T. FOR INNOVATION

**KANSAS: BUILDING AN
ENVIRONMENT FOR SCIENCE AND
TECHNOLOGY FOR INNOVATION**

Acknowledgements

THE DRAFTERS OF this report would like to acknowledge the contributions of a number of people who have made the Kansas B.E.S.T. science and technology plan possible. The Kansas Board of Regents is gratefully acknowledged for their role in charging the Council of Chief Research Officers with the drafting of the plan. Special recognition is given to Blake Flanders, Vice President of Workforce Development, and Gary Alexander, Vice President of Academic Affairs, of the Kansas Board of Regents for their assistance and support during the preparation of the plan, as well as to Stan Ahlerich, Kansas Governor's Council of Economic Advisors, for his helpful advice and the title of the plan. The encouragement of the Council of Chief Research Officers is also appreciated, including Tim Crowley at Fort Hays State University, Kathy Ermler at Emporia State University, Andy Myers and Peggy Snyder at Pittsburg State University, and Mike Russell at Washburn University. Special thanks go to David McDonald at Wichita State University, Ron Trewyn at Kansas State University, and Steve Warren at the University of Kansas for financial support.

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About the cover image

This image, provided by NASA's Earth Observatory, shows variegated green crop circles cover what was once shortgrass prairie in southwestern Kansas. The most common crops in this region—Finney County—are corn, wheat, and sorghum. Each of these crops was at a different point of development when the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) captured this image on June 24, 2001, accounting for the varying shades of green and yellow. Healthy, growing crops are green. Corn would be growing into leafy stalks by late June. Sorghum, which resembles corn, grows more slowly and would be much smaller and therefore, possibly paler. Wheat is a brilliant gold as harvest occurs in June. Fields of brown have been recently harvested and plowed under or lie fallow for the year.

Executive Summary

THE AMERICA CREATING Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act (America COMPETES Act) was enacted in 2007 and reauthorized in 2010. America COMPETES recognizes the need for increased attention to science education, research, and technology development.

In February 2010, new Kansas Governor Sam Brownback and Lieutenant Governor Jeff Colyer published the Kansas Economic Development Strategic Plan. This plan outlines bold goals for the future and a healthy and prosperous Kansas economy, and recognizes the important role that universities play in acting as “springboards” for new knowledge and providing access to new ideas that result from research and development—not to mention newly minted graduates.

Kansas is in a unique position to provide much-needed leadership in applying science and technology to economic development. With a strong historical foundation in agriculture, transportation, human and animal health, and education, a forward-thinking Kansas can take advantage of emerging strength in fields such as bioscience, climate and energy, and information technology to build a thriving, diverse economy with both local and national implications. Through this vision—presented here as Kansas Building an Environment for Science and Technology for Innovation (Kansas B.E.S.T. for Innovation)—Kansas can capitalize on the inherent strengths of the Board of Regents institutions to bring a new dynamism to the state, building an environment where science, technology, and the economy grow alongside the intellectual and business leaders of the future. Kansas B.E.S.T. for Innovation is a strategic plan that lays the groundwork for this future.

Kansas is ready for this challenge. Kansas researchers have proven their ability to begin projects that develop into multidisciplinary and multi-institutional centers and institutes of excellence. Kansans can and will be the leaders of the future in science and technology. This plan outlines Kansas’s historical strengths, target areas, and vision for the future, which is organized into four action goals.



STIMULATE discovery and innovation through partnerships by building on current areas of strength in agriculture, transportation, health, and education, and nurturing emerging areas of opportunity in bioscience, energy, and the environment

TRANSLATE the results of research into meaningful solutions to societal challenges by fabricating new and patentable devices and methodologies, and providing invaluable information for better-informed policies and partnerships with stakeholders

GROW the economy by applying new technologies and expanding access to information technology, resulting in vibrant and diverse economic development that brings tangible benefits to the citizens of Kansas and attracts new business to the state

EDUCATE a diverse workforce and the next generation of science, technology, and business leaders

Introduction

SCIENCE AND TECHNOLOGY have been undergoing a sustained revolution that has impacted daily life, education, industry, and economic growth as or more profoundly than the industrial revolution. Institutions, governments, and businesses that are not vigilant and forward-thinking risk being left behind. Furthermore, over the last decade, policy makers have increasingly expressed concerns about American global competitiveness in science and technology in innovation, development, and education. It has become incumbent upon all states to plan and seize opportunities to maintain American preeminence in science and technology.

In February 2011, the Office of the Governor released an Economic Development Strategic Plan as part of the “Roadmap for Kansas.” According to the plan, universities are “engines of economic development,” and are part of a “critical infrastructure” that supports economic development. The Kansas Board of Regents (KBOR) oversees many of the universities in Kansas. This body, consisting of nine members, provides coordination for the state’s seven public universities, nineteen community colleges, and six technical colleges. In summer of 2011, realizing the critical role the universities have in the economic well-being of the state, KBOR and the Chief Research Officers of the seven universities—the University of Kansas, Kansas State University,

Wichita State University, Fort Hays State University, Emporia State University, Pittsburg State University, and Washburn University—set in motion the development of this Kansas science and technology plan: Kansas, Building an Environment for Science and Technology (B.E.S.T.) for Innovation. This plan complements and leverages the goals and strategies put forth in the 2011 Economic Development Strategic Plan.

The goal of Kansas B.E.S.T. for Innovation is to provide a coherent, integrative vision for science and technology development in Kansas that builds on historic strengths and identifies areas of potential growth. State investment can improve programs, planning, and communication in a variety of scientific fields—and this investment can be multiplied many times over with federal funding and private investment. In this case, a rising tide indeed lifts all boats—creating jobs, growing

the economy, and improving lives.

Kansas has strengths, both historical and emerging, that make it an important resource in the national science and technology arena. This report identifies those strengths and establishes plans to sustain and expand the state’s commitment to science and research to compete with other states, regions, and countries.

In fact, a grand statewide process is already underway to continue the process of developing this science and technology infrastructure in



From the beginning, Kansans believed that opportunity is what we make of it; that all of us must be held accountable for both our action and inaction; and we believed that the future of Kansas is the responsibility of each of us and all of us.

Kansas Governor Sam Brownback



Kansas, one that is solid, distinctive, and targeted, as described in the Governor Sam Brownback's "Roadmap for Kansas." As part of this massive initiative, Governor Brownback's office is holding a series of "Governor's Economic Summits," which bring together public and private entities involved in the various engines of the Kansas economy to openly exchange ideas on what the state can do to help their industries grow and create jobs. The vision articulated here will work with these ongoing initiatives by building a dynamic, welcoming environment for science and technology that will foster innovation and, through private sector-university partnerships, catalyze a development boom. Kansas will fulfill its destiny as a heartland of industrial growth, technology start-ups, and world-changing innovations.

This report is designed to guide readers through the past (before 2000), present, and future of science and technology in Kansas, in each case demonstrating the state's advances and opportunities. The first major section, "History," presents how the state's traditional agricultural base has grown and expanded. The second section, "Targets," demonstrates how those historical

strengths have evolved to become critical drivers of economic growth and produce research with impact felt all over the country. This includes discussion of areas of traditional strength, developing areas, and growth opportunities. In each case, the report focuses on education and people; industry and cooperation; and responsibility and sustainability. And the final section, "Vision," brings all the previous material together in tangible steps, goals, and recommendations for the future.

History
Past

Targets
Present

Vision
Future



History

BY THE TIME the Kansas Territory joined the Union in 1861, it already had a reputation for its forward-thinking, pioneering spirit. Soon after Kansas became a state, several important national and local developments helped set the fledgling state on its course. The Pacific Railroad Act joined the vast nation's coasts with its interior. The U.S. Department of Agriculture was created, making farming a scientific and economic priority for the nation. And at about the same time, the Homestead Act offered free land to those with the drive and industry to claim and work it. The Morrill Land-Grant Acts in 1862, signed into law by president Abraham Lincoln, allowed the creation of land-grant universities. One of the first was Kansas State Agricultural College, now Kansas State University. Just days afterward, the University of Kansas was established under a charter from the state legislature. (Today both, along with four other state universities, are governed by the Kansas Board of Regents.) Once the Civil War ended in 1865, the state's population boomed, converting much of its seemingly endless prairie to farmland that remains among the most productive in the country.

As the state grew and developed, oil and gas and, eventually, aviation and healthcare, joined agriculture as primary drivers of its technology economy. Within these fields in particular, Kansas has a rich history in discovery, research, and the application of knowledge. These areas remain strengths, though they can be fickle—cyclical and market-sensitive. Furthermore, in the twentieth-century, many agricultural economies have experienced population declines and the phenomenon known as “brain drain,” in which some of the states’ best and brightest depart. It is absolutely critical that we work to reverse this trend by making Kansas an inviting environment in which to thrive and prosper. Education has always been a strength in Kansas’s science and technology history, and the importance of commercialization and private enterprise is clearly recognized. With the latest global challenges in science and technology in areas so close to Kansas’s natural strengths, our state stands on the threshold of being recognized as a leader in today’s science and technology enterprise.

AGRICULTURE



Since securing of the food supply became a critical national priority, Kansas has been at the forefront of agricultural science and technology. Early areas of focus included plant physiology and nutrition, the impacts of human activity on land, the appropriate use of the Kansas grassland prairie, and the health and well-being of food animals. In particular, the efforts in biotechnology at Kansas State University have improved a variety of crops, solving problems for farmers and adding value for consumers.

AVIATION



As the birthplace of Beechcraft, Cessna, Stearman, and Learjet, Wichita became an early hub of aviation research and manufacturing, and claimed the title of “Air Capital of the World” nearly 85 years ago. The National Institute for Aviation Research at Wichita State University is one the nation’s top aviation research facilities, with yearly expenditures topping \$49 million and expertise in everything from extending the life of aging aircraft to research and testing of the newest most innovative aircraft materials. It is complemented by Wichita’s National Center for Aviation Training, which provides training for skilled aviation jobs.

HEALTH



From the early days of house calls to the advanced research now taking place at the state’s universities, the health and well-being of Kansas citizens have always been top priorities. The medical center at the University of Kansas (KUMC), established in 1905, is of national significance. Not only is the associated Cancer Center striving to be designated a National Cancer Institute, but the pharmacy and medicinal chemistry programs are among the best in the nation. The College of Veterinary Medicine at Kansas State University, established the same year as KUMC, was joined in 2011 by the Advanced Education in General Dentistry program at Wichita State University, further attesting to the state’s record of strength in health and well-being.

EDUCATION



The doctorate-granting institutions in Kansas have a strong history of preparing the future Kansas workforce for the opportunities and applications of tomorrow. Basic scientific research can lead to important breakthroughs, resulting in substantial gains in productivity and economic competitiveness. A study by the Vice Provosts for Research at three Kansas universities on the impact of graduate education on the economy of the state of Kansas found that in 1999, advanced education in the state added some \$720 million to the tax rolls in Kansas, nearly \$300 million more than the state appropriates to the three largest universities. For every dollar invested in higher education by the state, \$6.80 is added to annual earnings in Kansas.

OIL AND GAS



Oil was discovered in Kansas in the early twentieth century, with production peaking in the 1950s. The Kansas Geological Survey of the University of Kansas conducts a range of research activities surrounding the geology and geophysics of hydrocarbon extraction, as well as studies of water usage and impact, in addition to educational initiatives. There has also been a highly recognized, long-term program in tertiary oil recovery at the University of Kansas.

ECONOMIC DEVELOPMENT



The Kansas legislature, recognizing the importance of science and technology in economic development established two engines of economic growth—Kansas, Inc. in 1986 and the Kansas Technology Enterprise Corporation (KTEC) in 1987. Kansas, Inc. conducted research and analysis in economic development, while KTEC promoted technology-based development through several strategies, including support of research at the state universities. Both entities played important roles in the economic development of Kansas. Recent examples of innovations developed in Kansas include resistant starch technology, ultrasound technology to monitor meat quality, and non-embryonic stem cell technology offering potential for human stem cell banking.

Targets

KANSAS'S HISTORICAL STRENGTHS have laid a firm foundation for future development and innovation in science and technology. Kansas B.E.S.T. for Innovation provides a vision and plan that will support, encourage, and advance the state's science and technology infrastructure and human capital to ensure competitiveness within the country and abroad. For those areas in which the state has a history of scientific expertise and infrastructure, such as agricultural science, traditional energy sources, aviation, and the health of the state's land, crops, animals, and citizens, Kansas B.E.S.T. for Innovation recommends how to build upon those inherent strengths in a sustainable fashion that allows the state to transcend economic cycles. In other fields, in which the state has a shorter but encouraging history, such as renewable energy, the environment, and advanced bioscience, Kansas B.E.S.T. for Innovation provides a roadmap for diversifying the state's research and commercial base. This plan also provides recommendations for areas in which infrastructure and commercial growth will support all fields of science and technology, with major positive influences on the state's economic growth, job creation, and prosperity.

AREAS OF STRENGTH

HEALTH AND WELL-BEING

AVIATION AND TRANSPORTATION

EDUCATION

AGRICULTURE

DEVELOPING AREAS

BIOSCIENCE

ENERGY AND ENVIRONMENT

MATERIALS

GROWTH OPPORTUNITIES

NETWORKS AND INFORMATION

INFRASTRUCTURE

INDUSTRIAL BASE

Health and Well-Being

THE HEALTH AND well-being of Americans have critical impacts both here and abroad. Health innovations often occur under the “one-health” concept of disease research, which establishes that the underlying biological principles of human, animal, and plant diseases have more similarities than differences. Understanding these fundamental mechanisms will impact health at all levels. Research into all three these forms of disease—foreign or domestic—will aid the ability to fight human health issues, from cancer to viral diseases to bacterial infections. Human healthcare innovations enhance the productivity of the workforce and can provide the basis for research centers that draw federal recognition and funding, as well as companies that enhance the state’s economic base. In addition, the human healthcare industries understand and build off of the animal health corridor that surrounds the Kansas City area. Food animal and food crop health are also critical for the agricultural economic well-being of Kansas and, indeed, the nation as a whole.

The University of Kansas Medical Center (KUMC) serves Kansas through excellence in education, research, patient care, and community engagement. In addition to a full range of undergraduate, graduate, professional, postdoctoral, and continuing education programs, KUMC boasts research strengths in a wide range of clinical areas, from cardiovascular research to telemedicine to brain imaging. Among these initiatives is the highly regarded University of Kansas Cancer Center, which is striving for National Cancer Institute designation from the National Institutes of Health. Such a designation would provide not only an exciting opportunity for economic growth in the state’s healthcare economy, but also national and even global recognition for the outstanding physicians and scientists associated with the Center.

With several of its research centers, Kansas State University builds upon its strength in ag-

ricultural research to examine the relationships among plant, animal, and human well-being. The Kansas State Arthropod Genomics Center (AGC) brings together resources and expertise in bioinformatics and functional genomics to support scientists in the application of genomic approaches to solving problems in arthropod biology related to human, animal, and plant health. And the Center for Emerging and Zoonotic An-



imal Diseases works to enhance the capabilities of the U.S. Department of Homeland Security by developing “state of the art” countermeasures for high-priority emerging and zoonotic animal diseases.

It is imperative that Kansas continues these successes, expands its medical research capabilities, and attracts more health-oriented businesses, all of which have positive impacts on economic growth and the health and prosperity of Kansans. Kansas B.E.S.T. for Innovation provides pathways for maintaining and expanding the state’s national reputation for excellence in health and well-being.

Aviation and Transportation

THE TRANSPORTATION INFRASTRUCTURE of America is a critical resource and a source of concern for the future. Kansas, because of its relatively low population and large distances between population centers, has often served as a testing ground for innovations in American transportation, particularly in aviation.

The National Institute for Aviation Research (NIAR) at Wichita State University supports the aviation industry by providing research, development, testing, and certification services to manufacturers, government agencies, and education entities. Laboratories at NIAR specialize in technologies such as aerodynamics, advanced coatings, aging aircraft, composites and advanced materials, computational mechanics, crash dynamics, and environmental testing. NIAR is the largest university aviation research and development institution in the United States. Because of its location in Wichita, an aircraft manufacturing cluster, NIAR is able to integrate business, government, and university entities to advance aviation technology. Further development of this research capacity will be critical in keeping Kansas at the

center of American aviation. Kansas B.E.S.T. for Innovation recognizes aviation as one of the state's great assets, and seeks to maintain the state's preeminence in the field. Further, most of the technologies explored at NIAR either currently are or could one day be applied to other transportation fields as well, including the biomedical, wind energy, automotive, marine, space, and rail sectors. Supporting research around these technologies will help diversify the state's manufacturing capabilities and make Kansas's manufacturing sector more robust.

In addition to the National Institute for Aviation Research, Wichita State University is a home to the National Aeronautics and Space Administration (NASA) Space Grant Consortium and the NASA Experimental Program to Stimulate Competitive Research. The University of Kansas maintains the Kansas University Transportation Center, the Kansas University Flight Research Laboratory, the Infrastructure Research Institute, and the Transportation Research Institute, all of which deal with various aspects of transportation. Kansas State's University Transportation Center specializes in rural transportation safety.



Education

E DUCATION IN THE sciences is a matter of critical national concern, as the nation has slipped behind many others in global rankings. The Kansas Board of Regents system provides a strong base for scientific training that is indeed penetrating educational structures throughout the state, from the Kansas's youngest budding scientists to the highest levels of education.

An especially encouraging effort is the Kauffman Foundation's establishment of a \$50 million, 10-year effort to enhance mathematics and science learning in the Kansas City metropolitan school districts through a learning network, teacher mentoring, and curriculum resources. Part of this effort is an Educational Research Consortium spearheaded by the University of Kansas Center for Science Education. The Center is also developing UKanTeach, a program that allows future science teachers to complete a four-year degree in a science major and state teaching certification at the same time. Kansas State, Wichita State, Emporia State, Pittsburg State, and Fort Hays State universities also boast science or science and mathematics education centers. Another key program is Virtual College of Fort Hays State University, which serves 5,500 students with 45 complete degree programs—including nine that provide credentials in the healthcare and technology sectors.



WICHITA STATE
UNIVERSITY

Pittsburg State University
Pittsburg, Kansas

KANSAS STATE
UNIVERSITY



WASHBURN
UNIVERSITY



FORT HAYS STATE
UNIVERSITY

EMPORIA STATE
UNIVERSITY™

KU

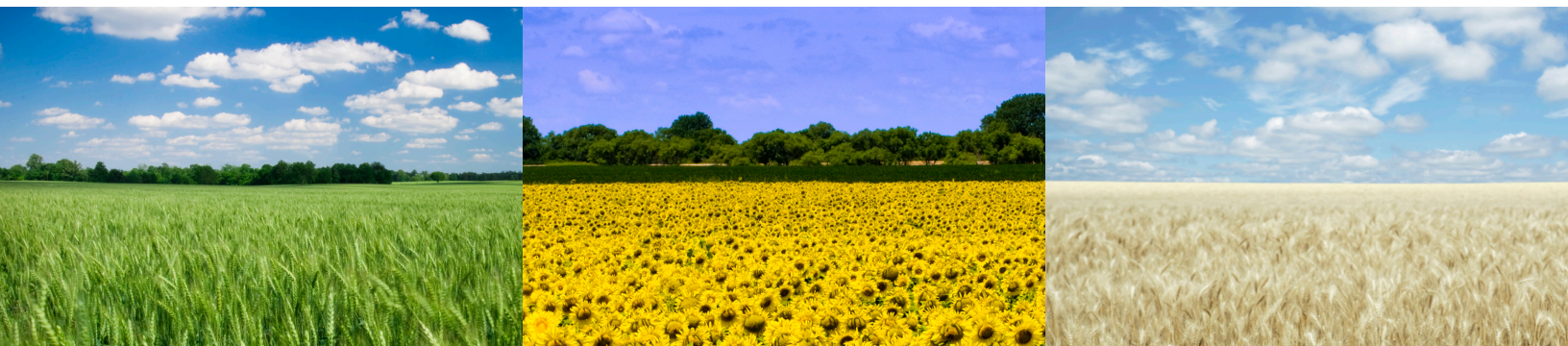
Agriculture

EVER SINCE FOOD security became a matter of national concern, Kansas has been one of the nation's great resources, for both agricultural production and innovation. As agricultural research evolves into the realm of biotechnology, Kansas remains at the center of guaranteeing the health of America's food supply and the economic health of its providers of produce and livestock.

True to its reputation as a land-grant institution, Kansas State University has always been involved in agricultural biotechnology. Over the years, the university's plant breeders have progressed in improving crops ranging from alfalfa

leadership of an international effort to develop a strategy and base funding for sequencing the genome of bread wheat.

Recently, Kansas State University also was selected as home to the National Bio and Agro-Defense Facility (NBAF), providing a rich opportunity to build an integrated, private-sector animal health economic growth sector for the state. NBAF will be a state-of-the-art biocontainment facility for the study of foreign animal, emerging, and zoonotic diseases that threaten U.S. animal agriculture and public health. NBAF will provide and strengthen the nation with critical capabilities to conduct research, develop vac-

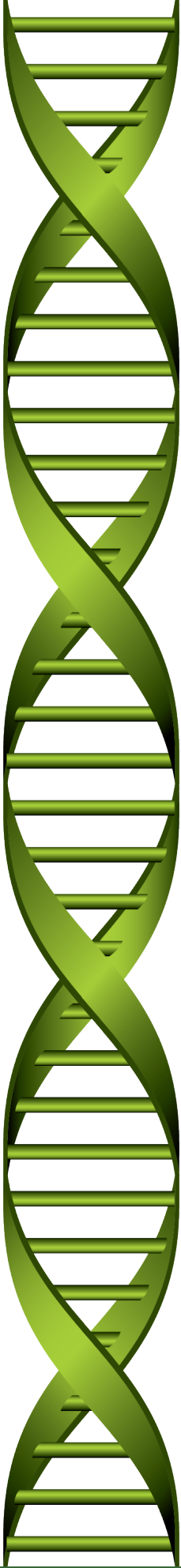


and melons to wheat, soybeans, and canola. Kansas State University scientists continue to conduct and publish basic research that can lead to future applications. The university's goal in biotechnology research is to solve problems for farmers and add value for consumers. Recently, for example, wheat and sorghum planting has declined significantly in Kansas, while planting of biotech crops that are more profitable for farmers has increased. Sustaining the wheat and grain sorghum industries has reached a critical point, with many experts predicting that a rebound will not be possible unless farmers are provided with new tools for weed control (in sorghum) and resistance to drought and heat (in both). Kansas scientists are leading the search for appropriate applications of agricultural biotechnology for these staples, including through

cines and other countermeasures, and train veterinarians in preparedness and response against these diseases. Just as federal biological research facilities in Maryland and Georgia have bolstered their surrounding research economies, so will the NBAF in Kansas. The facility will likely further cement Kansas as a major bioscience center in the United States and the world by spurring and attracting even more bioscience firms.

The NBAF was attracted to Kansas in part because of the state's clear dedication to developing its bioscience research capabilities. Bioscience research is a clear evolution of the state's traditional strength in agricultural technology. As we will see in the next section, bioscience research presents tremendous opportunities for Kansas to continue to build on its inherent strengths, and is a central pillar of the Kansas B.E.S.T. for Innovation plan.

Bioscience



BIOSCIENCE, IN ITS broadest definition, is the application of scientific methods to the study of biological systems. In practice, the term has come to mean many different things, reaching into the fields of energy, materials, health, agriculture, and technology. Kansas has made bioscience one of its top target industries for the present and future, in part by focusing resources into sectors in which the state has national leadership and expertise, including animal health, bioenergy, biomaterials, plant biology, and drug discovery and delivery. The state is investing in bioscience growth throughout the business cycle—from research and development to commercialization to expansion and attraction. Kansas B.E.S.T. for Innovation includes recommendations to take advantage of critical opportunities across the field.

In 2004, the Kansas Legislature passed the Kansas Economic Growth Act (KEGA) to invest more than \$580 million in the biosciences over the next 10 to 15 years. The passage of the act demonstrates Kansas's pioneering spirit and commitment to advancing the state's bioscience industry and research base. With this investment, Kansas stakes its claim on what is estimated to be 15 to 18 percent of the national economy during the next 20 years. Estimates compiled from Kansas Department of Labor data indicate that there are approximately 70,000 employees in 1,200 companies and universities engaged in the business of bioscience in Kansas. New bioscience facilities were built recently on the campuses of the University of Kansas, Kansas State University, and Pittsburg State University.

KEGA created the Kansas Bioscience Authority, which is charged with guiding and funding research, commercialization, and workforce development programs that support the growth of the state's bioscience research initiatives and bioscience in the private sector. The authority is working to recruit scholars, attract federal funds, encourage collaboration between industry and academia, make resources available to established and new companies, fund the construction and ongoing maintenance of bioscience research facilities, and develop an unrivaled bioscience workforce.



BIOSCIENCE CORE TARGETS

The Kansas Bioscience Authority identified several areas that should be the core targets of Kansas B.E.S.T. for Innovation.

ADVANCED MATERIALS AND MEDICAL DEVICES are critical keys to technological advancements in a number of industries. The medical device and diagnostics industry produces equipment designed to aid medical therapies.

ANIMAL SCIENCES is the field of study involving the production, marketing, and utilization of domestic animals in agriculture, entertainment, and companionship.

BIOMASS, BIOFUELS, BIOMATERIALS, AND OTHER ENVIRONMENTAL APPLICATIONS represent a subset of the myriad of applications of advanced biological sciences research.

DRUG DISCOVERY, DELIVERY, AND PHARMACOGENOMICS include target discovery and identification, lead discovery and identification, drug metabolism and toxicity, drug process and development, and application of genomics, proteomics, pharmacogenomics and bioinformatics in accelerating drug discovery and development.

HEALTH-RELATED INFORMATION TECHNOLOGY (INCLUDING BIOINFORMATICS AND TELEMEDICINE) is the convergence of computer science, information technology, and biotechnology. Telemedicine is the use of telecommunication to provide diagnostic and therapeutic medical information between a patient and doctor without either of them having to travel.

PLANT SCIENCES is the field of study involving the production, marketing, utilization and study of plants and plant materials.

Kansas B.E.S.T. for Innovation will work to overcome some of the obstacles to the accomplishment of these goals in bioscience, including a lack of venture capital funding, inadequate levels of federal funding, and the lack of a coordinated pipeline to provide Kansas's businesses with the bioscience workforce of the future.

Energy and Environment



The discharge zone of a minor glacier just south of the Helheim Glacier, Greenland, from a University of Kansas CReSIS expedition.

TWO OF THE world's most challenging problems, the accelerating impacts of global climate change and the pressing need for renewable energy sources, are closely interwoven in terms of cause and effect. Understanding these phenomena and their consequences is critical to managing natural resources, growing economies, enhancing human health, and improving quality of life. Solutions to these challenges can be obtained only by concerted, comprehensive research efforts to understand and address the looming issues of changes in climate and the need for clean sources of renewable energy. Kansas B.E.S.T. for Innovation recognizes the value of a strategy that incorporates all the state's resources, from the "grassroots" agricultural level in evaluating climate change in Kansas, to opportunities for the more efficient utilization of biofuel crops, to ultimately harnessing solar energy through nanotechnology.

Kansas's successes in this field to date are built, in part, on the strength of its study of

grassland ecology and remote sensing. The focus on understanding grassland ecology led to the establishment in the 1970s of the Konza Prairie Biological Station, an 8,000-acre outdoor living laboratory funded in part by the National Science Foundation's Long Term Ecological Research (LTER) program. The state also houses the Kansas Applied Remote Sensing (KARS) program at the University of Kansas, which, with a commercial partner, conducts research on environmental and agricultural applications of remote sensing technology. The University of Kansas is also the lead institution of the Center for Remote Sensing of Ice Sheets (CReSIS), a center established in 2005 by funding from the National Science Foundation to develop new technologies and computer models to measure and predict the response of sea-level change to the mass balance of ice sheets in Greenland and Antarctica.

The Center for Environmentally Beneficial Catalysis (CEBC), established in 2003, is also a

APPROACHING THE CLIMATE CHALLENGE

Kansas B.E.S.T. for Innovation places major emphasis on Kansas taking an increased leadership role in challenges that confront America and indeed the entire world. Universities in Kansas are employing a three-pronged approach used by the 2007 Nobel-Laureate Intergovernmental Panel on Climate Change to: (1) lay a strong foundation of basic science, (2) understand the impacts of climate change and energy needs, and (3) provide mitigation pathways for a new and brighter future.

BASIC SCIENCE involves modeling climate variables and investigating solar energy conversion by photosynthesis and man-made technologies.

IMPACTS includes the assessment of climate changes on farmlands in Kansas, including farmlands on indigenous soil, and a life-cycle analysis to examine how both biofuels and solar energy-derived electricity can be used together to achieve a greater balance of alternative energy sources.

MITIGATION involves interdisciplinary work to provide more efficient, novel answers to climate and energy issues, from carbon-sequestration and reduced agricultural greenhouse gas emissions, to industrial catalytic processes that can utilize carbon dioxide in the synthesis of industrial chemicals, to efficient conversion of biomass to biofuels and the use of nanotechnology in more efficient photovoltaic cells.



National Science Foundation—established center that adds to the state’s growing strength in environment-focused research. The goal of the CEBC is to provide new catalytic tools and processes for use in manufacturing that are both environmentally safe and economically feasible. The CEBC is now independent, boasting partnerships both with universities across state boundaries and with a number of well-known companies, such as ADM, Chevron Phillips Chemical, ConocoPhillips, and DuPont, among others.

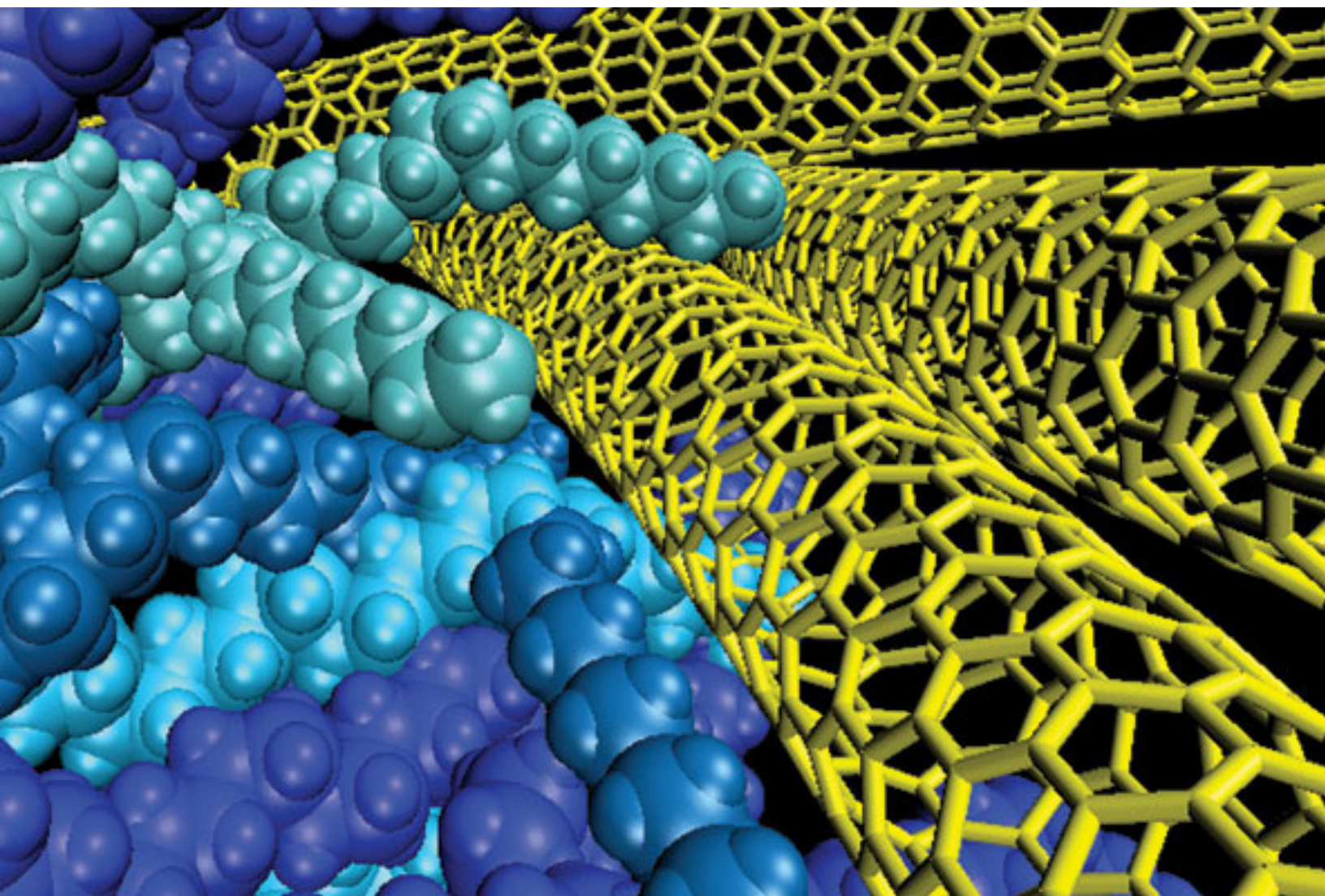
In a project funded by the National Science Foundation Experimental Program for Competitive Research, researchers in Kansas are addressing issues in the environment and energy with a fresh, integrative perspective. Strong components of information infrastructure, diversity (including a partnership with Haskell Indian Nations University in Lawrence), workforce development, and collaboration with out-of-state and international research institutions are vital to the success of such an effort.

Materials

DEVELOPMENT OF ADVANCED materials, including biomaterials and nanomaterials, is a critical building block of engineering applications in a variety of fields, from aerospace to bioscience. Kansas B.E.S.T. for Innovation looks to build upon existing strengths in materials development at a number of Kansas universities.

Kansas State University boasts a Center for Biobased Polymers by Design dedicated to replacing petroleum-based materials with more environmentally friendly biological polymers. A complementary effort is underway at Pittsburg State University, whose Kansas Polymer Re-

search Center is one of the world's leading centers specializing in vegetable oil-based polymer research and development. The focus on aviation technology at Wichita State University, makes it a world-known center for composites expertise—from the industry-driven composite manufacturing and repair programs of the National Center for Aviation Training to the groundbreaking materials classification efforts of the National Center for Advanced Materials Performance at National Institute for Aviation Research. Kansas B.E.S.T. for Innovation provides plans for leveraging these strengths into a diverse portfolio of materials development centers.



Kansas B.E.S.T. for Innovation identifies a critical goal in developing the infrastructure necessary to enable growth in all of the previously mentioned fields. In particular, the state faces challenges in its cyber infrastructure and industrial base. By encouraging development in both of these areas, all scientific and technological areas in Kansas will grow, enabling further investment in both.

Networks and Information Infrastructure

INFORMATION INFRASTRUCTURE

has been defined as the people, processes, procedures, tools, facilities, and technology that support the creation, use, transport, storage, and

destruction of information. It is as critical to the development of the innovation economy as factories, railroads, and roads were to the industrial revolution, impacting all areas of scientific and technological endeavor.

The first challenge in information infrastructure is connecting the state's research institutions with each other, the rest of the nation, and the people of the state. Kansas participates in the Great Plains Network, a consortium of Midwest universities to connect its member states—Kansas, Missouri, South Dakota, Nebraska, Oklahoma, and Arkansas—to the national research and education infrastructure. Despite this network, there are still information infrastructure needs in Kansas, and computational leaders at the University of Kansas, Kansas State University, and Wichita State University have discussed launching a statewide assessment of Kansas's needs. Also, the Great Plains Network itself has called for a meeting to discuss a regional assessment and plan for the future.

Further connectivity initiatives include the Kansas Research and Education Network (KanREN), founded in 1991 to create a statewide backbone network to extend Internet access to all Kansas higher education institutions. Kan-



REN provides regional connectivity throughout the state through its connection with the Great Plains Network and also links ecological sensor networks, such as those in the Konza Prairie Biological Sta-

tion's LTER project. Funding from the National Science Foundation recently allowed for an upgrade of the KanREN ring from 2 to 10 gigabits per second. Also, Kan-ed is a program to expand the collaboration capabilities of its member institutions, specifically K–12 schools, higher education institutions, libraries, and hospitals.

Beyond connectivity, information infrastructure also covers research into networking and communications technology. The Advanced Networking Research Institute at Wichita State University contributes state-of-the-art theoretical and experimental research in fields such as aviation networking, information security, and wireless networks. And the Information and Telecommunication Technology Center at the University of Kansas, one of the university's largest research centers, creates innovative technologies in telecommunications, information systems, bioinformatics, and radar.

Further development in both connectivity and network research will be critical to achieving the goals laid out by Kansas B.E.S.T. for Innovation, as they are critical enablers of research and research program development, and are an important attraction to high-technology business development.

Industrial Base

A **HEALTHY INDUSTRIAL BASE** makes a state attractive to companies and outside investment, and supports the research infrastructure that feeds it. As a strongly agricultural state, Kansas has not historically had a strong industrial base. However, some of the state's recent initiatives seek to address this problem. The establishment of Kansas Technology Enterprise Corporation and the Kansas Bioscience Authority are helping attract more industries to Kansas, and promote and support start-ups. A third organization, KansasBio, also works to promote the transition from research to commercialization in the biosciences in Kansas. Established in 2004 by the Kansas Technology Enterprise Corporation and the Kansas City Area Life Sciences Institute, KansasBio strives to link the bioscience industry with academic research institutions and economic development organizations to enhance both the bioscience business and research environments. Kansas B.E.S.T. for Innovation recognizes that there are great opportunities for attracting even more companies to Kansas with further initiatives.

The three research universities of Kansas, recognizing the importance of entrepreneurship, have promoted faculty-led start-up companies and established incubators to pursue partnerships between private businesses and the universities. For example, in 1995, Nantek, Inc. (now called NanoScale Corporation) was founded in Manhattan, Kansas, by a Kansas State faculty member. The company has now produced a number of materials for a range of applications, including odor and hazardous chemical neutralization, which fits in well with the environmental focus of Kansas's research and development enterprise. Crititech, a University of Kansas initiative, is another start-up, founded by a researcher at the University of Kansas. Its mission is to optimize drug delivery pathways with innovative, research-driven technology.

Today, all three research universities have designated centers to promote entrepreneurship and interaction between researchers and the private sector. In 2007, a new building was

dedicated as an incubator to build local industry from Kansas State University research, the Manhattan-K-State Innovation Center at the Kansas State Research Park. The university also boasts the Institute for Commercialization, dedicated to the start-up and expansion of technology-based, high-growth enterprises and enabling the commercialization of university and under-utilized corporate intellectual property. The University of Kansas Bioscience & Technology Business Cen-

POISED FOR THE FUTURE

In 1997 Senator Pat Roberts, in a visionary move, created an Advisory Committee on Science, Technology, and the Future. He populated the committee with Kansas experts from academia, business, industry, and the military. The committee was charged with promoting science and technology and advising the Senator about the state's needs. Kansas B.E.S.T. for Innovation builds on the foundation provided by this committee, and the organizations and networks that have been built through milestones such as the Kansas Economic Growth Act and subsequent developments in the biosciences and other areas of national and global importance.

ter, which opened in 2010, has locations at both the Lawrence campus and the Medical Center campus in Kansas City. It provides a mechanism for expanding the bioscience and technology industries through local and statewide partnerships focusing on start-up and emerging companies, as well as promoting interactions between researchers and large companies. Wichita State University's Center for Innovation and Enterprise Engagement was recently established to assist local manufacturing companies in enhancing their manufacturing processes and products. This center is particularly focused on advanced manufacturing in south central Kansas to bring the existing strengths of this area to the global economy. Though only a little more than a year old, the Wichita-based center has already received several large grants to support its activities.

Vision

VISION STATEMENT

TO BUILD AN ENVIRONMENT FOR SCIENCE AND TECHNOLOGY IN KANSAS BY UTILIZING THE HISTORICAL STRENGTHS OF KANSAS IN AGRICULTURE, TRANSPORTATION, AND HEALTHCARE WHILE SEIZING NEW OPPORTUNITIES FOR GROWTH IN BIOSCIENCE, ENERGY, CLIMATE, AND INFORMATION TECHNOLOGY.

KANSAS IS IN a special position because of the quality of its institutions of higher learning. The state's three research universities each have specific strengths that allow them to rise above their peers: the University of Kansas, vying for National Cancer Institute designation and with outstanding research in fields such as pharmacy and medicinal chemistry; Kansas State University, providing the hub for agricultural research and animal health in the state, with its recent designation as the site for the National Bio and Agro-Defense Facility; and Wichita State University with its long history of aviation excellence and as home to the National Institution of Aviation Research and the National Center for Aviation Training.

The regional universities and Washburn University also have niche areas of strength that provide additional substance to the science and technology enterprise in Kansas. Emporia State University is noted for its programs in fostering diversity at the K-12 level in science, technology, engineering, and mathematics careers. Pittsburg State University has an internationally recognized Kansas Polymer Research Center that provides a hub for vegetable oil-based polymer research. Fort Hays State University is noted for its innovative efforts to create international links, especially with China. Washburn University is noted for its School of Law.

Only by building true links and networks among all these Board of Regents institutions can Kansas be successful in becoming a recognized player in science, technology, engineering, and mathematics. As in all of science, the greatest discoveries are made through interdisciplinary efforts. So it must be for states such as Kansas, which, by leveraging its strengths with alliances and partnerships, can rise to the top in the science and technology. Kansas B.E.S.T. for Innovation provides four goals to accelerate our state toward achieving our vision.

STIMULATE
TRANSLATE

GROW
EDUCATE



STIMULATE DISCOVERY AND INNOVATION
THROUGH PARTNERSHIPS BY BUILDING ON CURRENT
AREAS OF STRENGTH IN AGRICULTURE, TRANSPOR-
TATION, HEALTH, AND EDUCATION, AND NURTURING
EMERGING AREAS OF OPPORTUNITY IN BIOSCIENCE,
ENERGY, AND THE ENVIRONMENT

TRANSLATE THE RESULTS OF RESEARCH INTO
MEANINGFUL SOLUTIONS TO SOCIETAL CHALLENGES
BY FABRICATING NEW AND PATENTABLE DEVICES AND
METHODOLOGIES, AND PROVIDING INVALUABLE IN-
FORMATION FOR BETTER-INFORMED POLICIES AND
PARTNERSHIPS WITH STAKEHOLDERS

GROW THE ECONOMY BY APPLYING NEW TECH-
NOLOGIES AND EXPANDING ACCESS TO INFORMATION
TECHNOLOGY, RESULTING IN VIBRANT AND DIVERSE
ECONOMIC DEVELOPMENT THAT BRINGS TANGIBLE
BENEFITS TO THE CITIZENS OF KANSAS AND ATTRACTS
NEW BUSINESS TO THE STATE

EDUCATE A DIVERSE WORKFORCE AND THE
NEXT GENERATION OF SCIENCE, TECHNOLOGY, AND
BUSINESS LEADERS

Stimulate

BASIC RESEARCH PROVIDES the foundation for all new discoveries and innovations. Kansas B.E.S.T. for Innovation has targeted nine areas in which the state proposes to excel. The vitality of all of these areas depends on basic research, and many of their basic science foundations are interwoven. For example, research into biofuels can be considered as part of bioscience, energy, the environment, agriculture, and transportation. Regardless of which category research efforts may be placed, they are highlighted because the creators of this plan believe that Kansas can play a major role in their development.

AREA OF STRENGTH: HEALTH AND WELL-BEING



Kansas has historically had a strong foundation in the health sciences, both human and animal. A fundamental tenet of the state's major universities is the "one-health" concept—that most biological principles governing health are the same in humans, food animals, and food crops. By working together through multi-institutional and multidisciplinary research, the state's universities can be leveraged into a formidable research and development force. The University of Kansas is noted for the strength of its School of Medicine and School of Pharmacy. Kansas State University has long been recognized for its outstanding College of Veterinary Medicine. Wichita State University now completes the circle with its newly instituted Advanced Education in General Dentistry program. Based on these strengths, key areas of coordinated attack include:

- ✦ **Global health challenges**, including HIV/AIDS, tuberculosis, malaria, and antibiotic-resistant diseases, through drug discovery research
- ✦ **Life span issues**, including age-related diseases, and cognitive and physical health
- ✦ **Human growth and language development** at the genetic and molecular levels
- ✦ **Autism**
- ✦ **Cancer and other debilitating diseases**, using drug design, bioengineering, and bioinformatics
- ✦ **Dental and oral health**, through new alliances between Wichita State University's dental program and the University of Kansas Medical Center.
- ✦ **Important diseases in food animals**, such as porcine reproductive and respiratory syndrome in swine and respiratory diseases in cattle
- ✦ **Protect food animals** and U.S. international agricultural commerce through new strategies for differentiating infected from vaccinated animals
- ✦ **Monitoring of foreign animal diseases**, which may enter the U.S. food animal or food crop supply chain

AREA OF STRENGTH: AVIATION AND TRANSPORTATION



With the tradition of strength in aviation at Wichita State University, ground transportation and aviation at the University of Kansas, and rural transportation at Kansas State University, Kansas is poised to become a strong base for transportation advances for the future. Kansas is therefore in an ideal position to address issues of critical importance in both the nation's skies and highways. Based on these strengths, key areas of importance include:

- ✦ **Aviation challenges**, including rapidly developing and certifying new aircraft technologies
- ✦ **Critical safety issues** involving repairing and extending the life of existing transportation and developing newer, safer materials
- ✦ **Roadway challenges**, including new materials for safer highways and bridges
- ✦ **Alternative fuel** choices and efficiency studies
- ✦ **Roadway safety issues**, especially in rural communities

AREA OF STRENGTH: AGRICULTURE



Agricultural biotechnology is an area of critical need for basic research in today's society. The changing climate—with drier growing seasons in some traditional agricultural centers—has severely hampered farmers' ability to make a viable living. Genetic engineering to produce crops resistant to drought and certain pests, while controversial, can be of great benefit to hungry nations. The placement of the National Bio and Agro-Defense Facility in Manhattan, Kansas, is poised to push Kansas State University into a position of national prominence as a recognized leader in agricultural and animal health and safety. Based on these strengths, critical areas include:

- ✦ **Challenges in animal diseases**, through bioinformatics and genomic approaches
- ✦ **Critical issues in disease, invasive species, and potential biological threats**, via the unique approach of the National Bio and Agro-Defense Facility
- ✦ **Ecological and arthropod genomics**
- ✦ **Analytical tools for lipidomics analysis**
- ✦ **Alliances in bioinformatics** across the research universities
- ✦ **Drought resistance in Kansas's major food crops**, such as wheat and sorghum, through both traditional and molecular genetic mechanisms
- ✦ **Enhancing the use of Kansas crops and their by-products in bioenergy production**

DEVELOPING AREA: BIOSCIENCE



With the passing of the Kansas Economic Growth Act in 2004, the Kansas legislature recognized the impact of research in bioscience on all sectors. Indeed, the field is breathtakingly broad: It includes biomaterials, plant and animal science, ecology, biomass and biofuels, as well as all health-related science, such as drug design and delivery, telemedicine, and the basic understanding of the workings of life. Also, the presence of National Bio and Agro-Defense Facility in Kansas is projected to provide significant impact to the state's bioscience industry. Researchers in Kansas have the advantage of important and, in many cases, unique foundations in this field that puts the state at the forefront in many of these areas. Based on these strengths, focus areas include:

- ✦ **Ecological genomics**, an emerging area that brings together the sciences of ecology with genomics, first developed at Kansas State University
- ✦ **Better diagnostic tools** for exploring the chemical composition of complex lipids, including potential partnership with other states for a National Science Foundation Center
- ✦ **Bioinformatics partnership** among the three research universities

DEVELOPING AREA: MATERIALS



Nanotechnology is a strong area of interest. Covering the scale from 1 to 100 nanometers, it is the penultimate contributor to materials research. The field provides new materials for a variety of areas, including manufactured products and coatings, polymers, and devices for applications such as solar energy. Pittsburg State and Kansas State universities seeded this area with the Kansas Polymer Research Center and Nanoscale Corporation, respectively, joined by the Nanofabrication Facility at the University of Kansas. Based on these strengths, key areas of coordinated effort include:

- ✦ **Advanced polymer and composite research** using the Kansas Polymer Research Center at Pittsburg State University as a hub for other biomaterials research
- ✦ **Life-cycle analysis research** currently taking place at Wichita State University, which evaluates the environmental impacts of materials over the life of the materials
- ✦ **Solar energy research** using nanotechnology using the Nanofabrication Facility at the University of Kansas as hub

DEVELOPING AREA: ENERGY AND ENVIRONMENT



Sustainability and affordable energy sources are two of today's greatest challenges. Changes in climate, including long periods of drought and hotter or colder seasons, affect the land, crops, and, ultimately, the economy. For example, streams in Kansas are dwindling and groundwater problems have become serious. Clean sources of energy are also needed to reverse the effects of pollution worldwide. Kansas is in an ideal position to address both these issues. At the center of the United States, Kansas has a climate that varies from wet in the east to dry in the west—a perfect natural climate laboratory. The state also has researchers working in nanotechnology (for more efficient solar energy conversion), biomass, and wind—three of the main clean alternatives to fossil fuel. Based on these strengths, areas of attack include:

- ✦ **Economically feasible use of biofuels**, through forming partnerships between researchers working with biodiesel (obtained from vegetable oils) and other sources such as algae
- ✦ **Synthesis of carbon-based mimics of the light-capturing chlorophyll molecule**, developed on the basis of the chemistry of photosynthesis at the molecular level
- ✦ **Chemical bio-refining**, through collaborative projects at Kansas State University (feedstocks, harvest and storage technologies) and the University of Kansas (catalysis)
- ✦ **Wind energy**, through partnerships between Kansas State University and Wichita State University
- ✦ **Water conservation and management**, through the Kansas Biological Survey and Kansas Geological Survey at the University of Kansas and programs at Kansas State University
- ✦ **Climate modeling and simulations** for better understanding of the effects of short- and long-term climate changes
- ✦ **Biodiversity sustainability**, including efforts at the University of Kansas Biodiversity Institute and Biological Survey, and the Ecological Genomics Institute and Kansas Lipidomics Research Center at Kansas State University
- ✦ **Energy storage**, one of the largest problems of getting solar and wind energy products onto the energy grid, using nanomaterial science for novel approaches

Translate

WHILE BASIC RESEARCH provides the foundation for all advances in science and technology, translating discoveries into innovations that revolutionize society is an important aspect of any science and technology plan. In addition to concrete innovations, an important role of basic research is to provide knowledge that can be accessed by policy makers to allow for more informed decisions and forge new alliances among those who will benefit from new discoveries, inventions, and policies. Policy maker and stakeholder partnerships are critical to enhancing and facilitating the discovery process. The following are examples of some of the potential inventions and alliances that will result from translation of basic research into tangible outcomes.

AREAS OF INVENTION

- ✦ Patents for new drugs, vaccines and drug delivery protocols
- ✦ Advances in telemedicine that allows for proper medical care in remote rural districts
- ✦ Improved disaster response protocols
- ✦ New, robust road materials
- ✦ Better materials for aircraft
- ✦ Bioengineered strains of plants less susceptible to climate changes
- ✦ Devices for implantation to monitor feedstock at long rural distances, by telemedicine
- ✦ Photovoltaic cells based on nanotechnology
- ✦ New climate modeling software programs to predict future climate change scenarios
- ✦ More efficient conversion of biomass and algae to biofuel sources
- ✦ Improved wind energy harvesting

POLICY MAKER AND STAKEHOLDER PARTNERSHIPS

- ✦ Trade policy and trade practice principles that support Kansas exports to markets worldwide
- ✦ Partnerships between Washburn School of Law, and the University of Kansas Institute for Policy and Social Research and its School of Law's Center for International Trade and Agriculture, to develop climate and energy policies for Kansas and the nation based on Kansas climate and energy research
- ✦ Partnerships with rural and urban stakeholders through social science research to change the culture of mistrust of science and technology that can pervade both types of communities
- ✦ Better networks of communication between scientists, engineers, academics, and the state's prominent stakeholders

Grow

A strong foundation of science and technology feeds the economy and supplies opportunities for vital growth in information technology and industry.

NETWORKS AND INFORMATION

OUR WORLD IS in the midst of a data revolution. The acquisition of knowledge is advancing at such a fast pace that it is a challenge to keep up with gigantic data sets, computational platforms, and software while navigating pitfalls, such as cybersecurity issues. Yet the rapid advances in the cyber dimension open up exciting new opportunities for research and collaboration across the globe. Any state with aspirations of leadership in science and technology must maintain a strong cyberinfrastructure. Kansas has benefitted from early investments in cyberinfrastructure through the creation of the Great Plains Network, the Kansas Research and Education Network, and Kan-ed. Now it is time to expand the state's cyber footprint to areas that will put Kansas on the map as a leader in technology.

Telemedicine
Bioinformatics
Cybersecurity
Connectivity

INDUSTRIAL BASE

ACCORDING TO THE Report of the Economic Impact of the National Bio and Agro-Defense Facility, employment in the bioscience industry is estimated to increase by 10 percent from 2018 to 2032. This equates to approximately 1,100 new jobs and 34 new bioscience-related businesses. A successful science and technology enterprise can have tremendous impact on economic growth from both newly born businesses and entrepreneurs already located in Kansas, as well as draw interest from businesses based outside of the state. Kansas possesses wide open spaces for new buildings and facilities, and low overall business overhead and other costs compared with the highly popular urban areas on the coasts. With this in mind, key areas of attack will be in providing an incubator for start-up companies and a friendly atmosphere for businesses immigrating to Kansas.

To support start-ups and create an environment that incubates innovative business ideas and concepts that grow out of research in the state, it will be important to develop alliances between the economic development centers, including the Center for Innovation and Enterprise Engagement at Wichita State University, the Bioscience & Technology Business Center at the University of Kansas, and the Institute for Commercialization and the Advanced Manufacturing Institute at Kansas State University.

To attract new companies to Kansas relies on enhancing Kansas's science and technology enterprise, as proposed in this plan. Build it and they will come. Target industries include bioscience, information technology, healthcare, transportation, and manufacturing.

Educate

A **KEY FOCUS OF** the reauthorized America COMPETES Act is on youth and educating the leaders of tomorrow. In addition to the state's traditional and emerging strengths in a number of fields, Kansas is also home to institutions that serve minority populations, such as the inner-city schools in Kansas City (Kansas), Topeka, and Wichita, as well as Haskell Indian Nations University in Lawrence. American society cannot afford to overlook the potential contributions of children who have not had the privilege of affluent families, children who are first-generation college students, and children from underrepresented ethnic, racial, or otherwise disadvantaged groups. To ensure that Kansas builds the diverse, empowered workforce of the future, it is essential to:

- ✦ Create partnerships among the three research institutions and the regional schools, including Washburn University
- ✦ Forge alliances with the universities' science education centers through joint programs and initiatives that become statewide, rather than local
- ✦ Forge alliances among the graduate programs at the three research universities to facilitate writing of multi-institution training grants, such as National Institutes of Health's biomedical research training programs and the National Science Foundation's institutional graduate research training programs
- ✦ Support summer Research Experience for Undergraduates programs
- ✦ Support summer Research Experience for Teachers programs that expand to collaborations throughout the year
- ✦ Institute an Undergraduate Research Day at the Capitol
- ✦ Enhance and broaden successful programs for underserved populations, including Pathways at Haskell Indian Nations University, Mathematics And Science to Explore caReers-Investigating Together (MASTER-IT) and Si Se Puede Hacer Ciencias y Matematicas at Emporia State University, and National Institutes of Health Bridge programs at the University of Kansas and Kansas State University

Conclusion

KANSAS IS IN a unique position to provide much-needed leadership in science and technology. Twenty years ago, the state became eligible to participate in an experimental National Science Foundation program designed to help states that receive a lower percentage of federal dollars for research to build research infrastructure, the Experimental Program to Stimulate Competitive Research (EPSCoR). Since that time, Kansas NSF EPSCoR has provided seed funding prototype projects that led to an Engineering Research Center, the Center for Environmentally Beneficial Catalysis, and a Science and Technology Center, the Center for Remote Sensing of Ice Sheets. The Center for Plant Lipid Systems, now a multi-state initiative and seeking funding from the National Science Foundation has also grown and flourished in the last 10 years, bringing in millions of federal dollars. Indeed, state funding of seed projects such as these has been leveraged 10-fold, and almost 100-fold in some cases. The National Science Foundation is not the only federal agency with such a program. The National Institutes of Health, Department of Energy, and National Aeronautics and Space Administration also have programs for states that receive lower percentages of federal dollars for research. The National Institutes of Health have provided even more dollars for health-related research through IDeA (Institutional Development Awards), INBRE (IDeA Networks of Biomedical Research Excellence), and CoBRE (Centers of Biomedical Research Excellence awards). These awards have provided considerable seed funds for Kansas researchers to begin projects that develop into multidisciplinary and multi-institutional centers and institutes of excellence. The results prove the case that Kansans can and will be the leaders of the future in science and technology.

A NOTE ON ORGANIZATIONAL STRUCTURE

To oversee a statewide science and technology plan that is effective in accomplishing all of these stated goals, it is necessary to have an oversight committee that works closely with the Council of Economic Advisors established in the state's Economic Development Plan. The Council of Science and Technology Advisors will be appointed, and will consist of a diverse group of leaders in research and business, with representation from both rural and urban Kansas. This council will monitor the progress of the science and technology enterprise in the state and take advantage of emerging opportunities, providing, when necessary, course changes to the science and technology plan.

