It’s a story we often talk about but sometimes don’t really appreciate. Abraham Lincoln signed the Morrill Act of 1862 to create the land-grant system of institutions that includes what is now Oklahoma State University. The agricultural and industrial focus of the land-grant movement transformed the United States from a young, hardscrabble nation into one hungry for knowledge and greater opportunities for the working classes through education. The 2018 issue of OSU Research Matters celebrates our part in that legacy and shows why land-grant universities are needed as much today as they were 155 years ago.

Along with its land-grant story, this issue of OSU Research Matters includes two other themes that shaped OSU’s history. Although fewer people realize it, OSU is not only Oklahoma’s only 1862 Land-Grant university, but OSU is also a Sun Grant institution and a Space Grant university. OSU’s leadership in the nationwide Sun Grant network is remaking rural America through research and development projects that create sustainable, made-in-America bioenergy products. The Space Grant designation highlights OSU’s long-standing partnerships with NASA and our leadership of the Oklahoma Space Grant Consortium. OSU’s NASA efforts have opened doors to countless scientists, engineers and students to hands-on work that advances space travel and exploration.

Knowledge is power that improves lives and strengthens communities. Just look through OSU Research Matters. The magazine is full of stories about how OSU’s vision is in lock-step with the land-grant mission. Stories include basic and applied veterinary medical research helping animals and humans; OSU’s Food & Agricultural Products Center that gives entrepreneurs across Oklahoma the knowhow to develop and improve food products; an OSU Library program that is shedding light on the life experiences of centenarians; and scientists creating markets for switchgrass and even red cedar to produce energy. These are stories that tell why #OSUResearchMatters to the citizens of Oklahoma, the nation and the world.

Sometimes it’s easy to forget what being a land-grant university really means. Even so, Oklahoma State University’s history has been shaped by that legacy. Every OSU student and faculty member is impacted by our land-grant mission – whether they realize it or not. Once you read through OSU Research Matters, you will be impacted, too. I am proud of the research taking place here at OSU, and how we share it with our students and the world. It’s a story worth telling.

Kenneth W. Sewell, Ph.D.
Vice President for Research
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BACK COVER  Cox Fellows excel in genetic research
Prior to the Civil War, farmers were gathering to advise each other on planting and harvesting methods. The agriculture industry was growing rapidly, but it lacked a trained workforce. To complicate matters, access to a college education was extremely limited for rural and non-affluent Americans. Therefore, President Lincoln signed the Morrill Act in 1862 giving large tracts of federal land to states in exchange for the creation of universities—land-grant universities—dedicated to filling these education and training gaps. Congress soon recognized the vital role that research must play at these institutions and broadened the change into the tripartite mission of instruction, research and outreach. Born as Oklahoma A&M, our state’s flagship land-grant university even before statehood, Oklahoma State University continues to embrace the land-grant mission in service to Oklahoma, the nation and the world.

Burns Hargis, President of Oklahoma State University

Oklahoma State University’s mission was born from its land-grant heritage. The mission of all land-grant institutions is instruction, research and extension, and since its founding in 1890, Oklahoma State University has remained true to that commitment by providing a world-class education, pursuing life-changing discovery and sharing both with Oklahoma, the nation and the world.”

Gary Sandefur, Provost and Senior Vice President of Academic Affairs

The missions of Oklahoma State University and other land-grant institutions remain as they have been from the beginning: research, instruction and extension. The research done at OSU is important in and of itself, but also feeds into instruction of our undergraduate and graduate students and into the extension and service activities of the university.

Kenneth Sewell, Vice President for Research

When I think of land-grant, I think of relevance—the relevance of our research, our academic programs and the way we make those things accessible and beneficial to the people we serve. President Lincoln and the leaders of his era grappled with controversies and conflicts even more extreme than the ones our society faces today...yet they understood and invested in land-grant universities. They changed the world, and thereby charged us to do likewise. I’m proud to be at OSU, a land-grant university embracing that charge.”

Knowledge to Grow with a Practical Education

For more than 125 years, OSU has lived its land-grant mission

Founded in 1890, Oklahoma State University’s mission is, “Building on its land-grant heritage, Oklahoma State University promotes learning, advances knowledge, enriches lives and stimulates economic development through teaching, research, extension, outreach and creative activities.” As one of two land-grant universities in the state, Oklahoma State University has been home to research in agriculture and mechanics for more than 125 years. Keeping with the land-grant tradition, research shared has improved the lives of Oklahomans and people across the U.S. and even the world. But what exactly is a land-grant university, and how did it become part of the history of higher education? The answer begins within the foundations of our country.

Agriculture pushed forward the civilization and urbanization of rural America. Early Presidents George Washington and Thomas Jefferson were farmers; Washington farmed tobacco on his Mount Vernon estate and Jefferson’s Monticello was a productive wheat farm. In a 1787 letter to Washington, Jefferson wrote, “Agriculture...is our wisest pursuit, because it will in the end contribute most to real wealth, good morals, and happiness.” Jefferson saw the importance of agriculture to our nation, but federal funding for education in agriculture did not exist until the middle of the 19th century.

In the early 1850s, Jonathan Turner of Illinois led a political movement to establish colleges to teach agriculture. From this, the state of Michigan enacted a bill in 1855 to develop the United States’ first agricultural college. This laid the foundation for the first introduction of the Morrill Act in 1857, named after the bill’s author, U.S. Rep. Justin Smith Morrill. The legislation would create colleges for the teaching of agriculture and engineering. Originally passed by Congress in 1859, President James Buchanan unceremoniously vetoed the act, deeming it unconstitutional.

In 1861, Morrill reintroduced the act with an added clause to include the training and teaching of military tactics. Amidst the Civil War, President Abraham Lincoln signed it into law in 1862 with the addition of the military clause believed to be a deciding factor for passage.
The Morrill Act of 1862 was designed to be “an Act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts.” The act allocated 30,000 acres of federal land to Union states for each member of Congress based on the 1860 census. Following the Civil War, the act was expanded to include former Confederate states, and new states as they were granted statehood. Under the Morrill Act of 1862, Oklahoma Agricultural and Mechanical College, now Oklahoma State University, was established in the Oklahoma Territory in 1890.

With the development of land-grant universities, there was a need for research to improve the educational framework. In 1887, the land-grant mission expanded when Congress passed the Hatch Act, which gave federal money to land-grant colleges to fund agricultural experiment stations for research to maintain a “permanently effective agricultural industry.”

In 1897, the university planned to build dormitories on the original Magruder plot location. Horace Harper, lead researcher of the Magruder plots, directed the relocation of 500 tons of soil from the original plot to preserve it for research. Today, the soil Magruder tilled in 1892 is part of a plot on the Agronomy Farm west of campus and continues to be used for wheat research.

The 1914 Smith-Lever Act added the final piece to the land-grant mission. It created Cooperative Extension Services for each institution, allowing for the dissemination of information produced by university experiment stations. Working with the U.S. Department of Agriculture, the information was originally intended to help farmers combat pests and disease, and it also shared best practices for soil conservation and animal husbandry.

Early extension services provided organized and systematic education, including short courses taught both on and off campus. In addition, on-campus courses served as education for individuals who could not afford to attend the institution. Since 1914, Cooperative Extension has expanded to include OSU colleges teaching veterinary medicine, human sciences, arts and sciences, business administration, education and engineering at Oklahoma State University. The land-grant mission to spread information is just as important now, using modern communications, as it was more than a century ago, when early farm agents traveled by horseback to spread agricultural research findings.

More than 100 years since the passage of the Smith-Lever Act, professors and extension agents associated with OSU continue to work on groundbreaking research affecting the agricultural industry. In the Department of Plant and Soil Sciences, Brian Arnall (see sidebar) leads student researchers in the OSU Precision Nutrient Management Project, focusing on improving plant yields by implementing precision practices in agriculture. Arnall credits the land-grant mission as “an opportunity to do unbiased research and give information directly to farmers.” He emphasizes the importance of utilizing the three parts of the land-grant mission, by using research opportunities to teach real-world experiences to students and providing practical solutions to farmers. The Precision Nutrient Management Project exemplifies the connectivity of the land-grant focus on education, research and extension and is shared with producers through social media, Cooperative Extension and the program’s website.

Today, students at Oklahoma State University are given immense opportunities to define the future of agriculture and research. The series of historic acts beginning in the mid-19th century laid the foundation of the land-grant mission, which established the tradition of research and education at Oklahoma State University. It is both rewarding and exciting to be part of an institution where students learn in a hands-on environment while also shaping the future of the great state of Oklahoma.

Recognizing the embodiment of the land-grant mission

The role of a land-grant university and its faculty includes the creation, teaching and dissemination of knowledge. In 2017, Brian Arnall was recognized with the Award of Excellence, Advancement of the Land-Grant Mission of Oklahoma State University for his efforts in all three parts of the land-grant mission.

Arnall, associate professor and holder of the Nutrients for Life Foundation Professorship of Soil and Crop Nutrition, serves as a precision nutrient management extension specialist who, according to William Raun, Regents Professor in plant and soil sciences, has had contact with more than 15,000 producers, extension agents, industry representatives, students and faculty in his career with OSU.

Along with direct contact, Arnall also uses technology to spread the results of his prolific research output. He uses social media, created a website for ag producers on nutrient management and has authored or co-authored seven smart device apps. As a teacher, he instructs more than 70 students each semester, often relying on teaching materials that he created.

“It has been my pleasure to work with Brian as a part of an extension team devoted to fulfilling the land-grant mission through the development and delivery of cutting-edge research to end users,” Jason Warren, associate professor in plant and soil sciences, wrote in a recommendation for Arnall.

The land-grant mission at OSU now includes research that helps new communities like the work of Amanda Sheffield Morris.

Undergraduate biology students will take a world-class education into the future to discover new ways to serve.
A LEGACY OF PIONEERING VET MED RESEARCH CONTINUES

For 70 years, CVHS research has touched both animal and human lives

BY DERINDA BLAKENEY

On March 1, 1948, the doors to the Oklahoma A&M School of Veterinary Medicine opened to 31 eager men. Twenty-six would complete the program, earning doctor of veterinary medicine degrees in May 1951. Oklahoma A&M changed its name to Oklahoma State University in 1957, and the school became the College of Veterinary Medicine until 2004 when the CVM became the Center for Veterinary Health Sciences (CVHS). The vet school’s 70 years of instruction and research will be celebrated in 2018.

Throughout its history, CVHS has been home to world-class research in bacterial and viral diseases, parasitology and tick-borne infections, exercise physiology, lung and respiratory diseases, toxicology and many other areas impacting the health of both animals and humans. Here is a look at veterinary medicine’s ground-breaking researchers, past and present, and research areas where OSU has had widespread influence in animal and human health:

BOVINE DISEASE

Bovine respiratory disease (BRD) costs Oklahoma’s cattle industry more than $200 million annually in lost productivity, treatment and deaths.

As early as 1969, Professor Emeritus Roger Panciera began researching BRD. Anthony Confer, Regents Professor Emeritus, with others, delved into bovine viral diarrhea, vaccines and bovine respiratory coronavirus. Clinton Jones, Sitlington Chair in Infectious Diseases, studies bovine herpes virus 1 (BHV-1) and herpes simplex virus type 1 (HSV-1). Since BHV-1 is one of the most important viruses associated with bovine respiratory disease, Jones seeks to make vaccines that protect animals from infection and prevent latency. Fellow scientist Jean d’Offay, who also studies BHV, examines viruses including an AIDS-like virus in baboons.

“Understanding what makes the virus cause serious disease will allow researchers to develop a better vaccine,” d’Offay says.

TICKS AND TICK-BORNE DISEASES

Katherine Kocan, Regents Professor Emerita, spent more than 40 years researching ticks and tick-borne diseases. Kocan made pioneering discoveries about tick-borne pathogens and disease transmission.

She developed a cell culture system for Anaplasma marginale, reducing the need for animals in research. Kocan’s team developed a new bovine anaplasmosis vaccine for cattle and a sheep model for the study of human granulocyte anaplasmosis.

PARASITOLOGY

The founding department head was legendary parasitologist Wendell Krull. One of his students, Sidney Ewing, Emeritus Faculty and Professor Emeritus, continues Krull’s work. Ewing first described the bacteria Ehrlichia canis in North America, and later identified new species including E. ewingii, which was named after him.

Regents Professor Susan Little holds the Krull-Ewing Endowed Chair. A renowned parasitologist and tick expert, Little studies organisms and tick-borne diseases affecting dogs and humans. She also founded and is co-director of the National Center for Veterinary Parasitology, housed at CVHS.

PHOTO / OSU LIBRARY

The first home of the Oklahoma A&M School of Veterinary Medicine in 1948.

PHOTO / COURTESY CVHS

Center for Veterinary Health Sciences researchers Roger Panciera (front) and Richard Constantine led early studies of bovine respiratory disease.

PHOTO / PHIL SHOCKLEY

Katherine Kocan made pioneering discoveries about tick-borne pathogens and disease transmission.

PHOTO / PHIL SHOCKLEY

Susan Little founded and is co-director of the National Center for Veterinary Parasitology at CVHS.
Tularemia, or rabbit fever, research was started by Panciera, continued with Rebecca Morton, professor emerita, and continues with others in parasitology. Tularemia can be transmitted to people from ticks and infected wildlife and attacks many organs. While treatable, tularemia can be fatal.

BIOMEDICAL LASER SURGERY LABORATORY

Percutaneous laser disk ablation surgery for dogs was perfected by Kenneth Bartels, professor emeritus. Small needles are inserted into the intervertebral disk and serve as the fiber conduit for the holmium laser, which vaporizes the nucleus of the disk, preventing it from herniating.

ANIMAL EXERCISE PHYSIOLOGY

Michael Davis, the Oxley Chair in Equine Sports Medicine, has achieved research success through the center’s Comparative Exercise Physiology Lab, including looking at how Iditarod sled dogs persevere in the grueling race in Alaska and how that equates to human behavior. His work impacts pesticide risk assessment and how chemicals in different classes are evaluated and regulated. Pope’s lab is working with a group of scientists on a project to protect soldiers and first responders from nerve agents. Pope was instrumental in establishing the university’s Interdisciplinary Toxicology Program, which fosters collaborative research among faculty from different disciplines and cross-trains students in the use of multidisciplinary research.

Oklahoma Center for Respiratory and Infectious Diseases

OOCRID was established with an $11.3 million National Institutes of Health grant. The center is directed by Lin Liu, a Regents Professor who holds the Lundberg-Kienlen Professorship in Biomedical Research. OOCRID research includes the collaborative study of influenza virus infection and lung diseases conducted with OSU colleges, the University of Oklahoma and the Oklahoma Medical Research Foundation. Liu also works with the Oklahoma Center for Adult Stem Cell Research.

Results of early stem cell experiments suggest the treatment of many diseases and injuries could benefit including lung, heart, Alzheimer’s and Parkinson’s diseases as well as cancer, diabetes and spinal cord injuries.

Other CVHS Research Leaders

Richard Eberle, Lara Maxwell and Grant Rezabek focus on herpes viruses that affect primates, humans and horses. Monkey B virus and Herpesvirus Papio 2 (HVP-2) can produce horrific neurological disease and death in most infected people. Maxwell and Rezabek are also working on a multidisciplinary team studying the mitigation and prevention of equine herpesvirus myeloencephalopathy.

Pamela Lloyd and her team study cardiovascular physiology in humans and animals. “People with atherosclerosis would benefit where one of their arteries is blocked so the heart isn’t getting enough blood,” Lloyd says. “By getting blood vessels to grow around that blockage, this could potentially replace a bypass surgery and prevent heart attacks.”

Ashish Ranjan, Kerr Foundation Endowed Chair, focuses his research on cancer.
FAPC helps entrepreneurs take value-added products worldwide

BY MANDY GROSS

Oklahoma State University’s Robert M. Kerr Food & Agricultural Products Center has been serving the state’s food and agricultural industries for more than 20 years. FAPC opened its doors in early 1997, and its research laboratories, pilot-processing facilities, educational programs and seminars keep food and agricultural processors and entrepreneurs on the forefront of cutting-edge value-added processing and technology.

“FAPC was launched with a tremendous vision of helping value-added food and agricultural companies across the state, but no one had an idea of how it would actually flesh out,” says Roy Esconhas, FAPC director.

Two decades later, the center, a part of OSU’s Division of Agricultural Sciences and Natural Resources, is going strong and has assisted more than 1,000 Oklahoma clients through 5,000 technical and business projects. The center’s strengths in spreading expertise epitomize the land-grant mission.

By offering large and small businesses, producers and entrepreneurs access to faculty and staff expertise in business and technical disciplines, FAPC strives to discover, develop and deliver information that will stimulate and support the growth of value-added food and agricultural products and processing in Oklahoma.

“The creation, development and structure of FAPC are quite unique,” Esconhas says. “FAPC is truly a one-of-a-kind, special model for research, teaching and extension to the food-processing industry, meeting the land-grant mission.

“Research at FAPC is useful to food processors to keep them aware of and better able to take advantage of cutting-edge technology and trends.”

FAPC specializes in multiple disciplines including oilseeds and oilseed extracts science and technology, small grains science, muscle foods science, economics and value-added food and agricultural business development, food product and process engineering, horticultural food products, food microbiology and forest products.

One of the first projects that brought notoriety to the center was P.B. Slices in 2000.

“A lunchtime talk about crazy food ideas sparked the idea for the product,” says Dani Bellmer, FAPC food engineer. “The goal was a shelf-stable, easy-peel-from-the-wrapper peanut butter slice with flavor, texture and color as close to regular peanut butter as possible.”

After years of work, the peanut butter slice technology was licensed and P.B. Slices eventually made its way to grocers’ shelves.

FAPC also discovered a new beef steak, which was unveiled at the Protein Innovation Summit in Chicago in 2012.

“The Vegas Strip Steak is the latest and perhaps last steak to be found from the beef carcass,” says Jacob Nelson, FAPC meat processing specialist.

Following the discovery, the research team filed a patent to protect the fabrication of the beef cut, which was granted in 2016. A recent project involves helping US Roaster Corp in Oklahoma City market a small, smokeless electric coffee bean roaster with cloud connectivity.

FAPC’s development of Vegas Strip Steak offers cattle producers a new market for a value-added product.

FAPC’s relationship with US Roaster Corp, which specializes in new roaster fabrication and rebuilding older roasters, sparked in 2009 when the company began manufacturing its flagship roaster, The Revelation, the world’s first industrial roaster to meet air emission standards in southern California.

The new mini coffee bean roaster design is based on The Revelation and can roast a batch of beans in 8 to 16 minutes. Target customers include small coffee shops in the United States, China and Europe that want to add whole bean roasting to their operations.

“What makes this roaster unique is users can share roast profiles through the cloud,” says Dan Jolliff, owner of US Roaster Corp. “Being able to make coffee exactly the same from user to user is a benefit.”

The mini Revelation allows users to connect a handheld electronic device to download and upload profile formulations with scalability from small to large roasters.

The roaster also includes an interchangeable dishwasher-safe drum.

With FAPC’s assistance, US Roaster Corp received a grant from the Oklahoma Applied Research Support Program in the Oklahoma Center for the Advancement of Science and Technology (OCAST) to improve the low-cost roaster.

“The grant is helping US Roaster Corp automate the controls of the mini, cloud-enabled Revelation; achieve full connectivity between the control system, handheld devices and the cloud; and establish a high-volume manufacturing line to meet current and forecasted demand for the new roaster,” says Tim Bowser, FAPC food engineer. “Working together with OCAST, OSU, industry partners and professional groups allowed US Roaster Corp to implement these goals.”

Because of the partnership between FAPC and US Roaster Corp, Jolliff connected with OSU faculty, staff and students, giving him additional resources. As a result, he has employed several OSU students, and two have become full-time employees.

In addition to Bowser, OSU personnel working with US Roaster Corp include Ning Wang, Rajesh Krishnamurthy and Don Lake, department of biosystems and agricultural engineering; Malakhi Achanta, doctoral student; Spencer Currty, master’s student; Susan Weckler and Jesse Bowser, undergraduates; and Mathews Barbosa and Joseph Barnes, OSU graduates and full-time employees of US Roaster.

Jolliff says working with FAPC on the mini Revelation through the OCAST grant has helped the business grow.

“It’s been an educational experience as a business owner, and we wouldn’t be where we are today without the help of OSU,” he says. “Having an open line of communication with OSU to get help, solve problems and answer questions is second to none.”
James Smay, associate professor of materials science and engineering at OSU-Tulsa, collaborated with U.S. Department of Energy scientists at Lawrence Livermore National Laboratory to develop a breakthrough 3-D printing process for high-quality glass for optics.

The 3-D printing process makes an optically transparent glass of higher quality than previous technologies are capable of. The process also promises to make printing glass cheaper and easier.

BY KIM ARCHER

An Oklahoma State University-Tulsa professor is part of a national research team that is revolutionizing the 3-D printing of glass — a promising first step toward improving lasers, microscopes and telescopes.

Scientists have discovered a process that refines transparency of glass components and opened a pathway to creating optical lenses or filters that are smaller, more affordable and easier to produce, says James Smay, associate professor of materials science and engineering at OSU-Tulsa.

Along with a team of world-class scientists at the Lawrence Livermore National Laboratory in Livermore, Calif., Smay has worked nearly three years to develop a 3-D printing method that allows components to be custom-made with more precision.

“The importance of glass as an engineering material is well-known, and researchers worldwide are seeking to use 3-D printing to control composition and structure for the advancement of numerous optical devices,” Smay says. “The goal is to produce optical components with more complex refractive capabilities.”

Under the auspices of the U.S. Department of Energy, Smay and the team successfully demonstrated the new 3-D printing technique, and the breakthrough was reported online in the scientific journal Advanced Materials in April 2017.

Generally, 3-D glass printing consists of extruding molten glass through a nozzle at 1,800 degrees Fahrenheit or by using lasers to melt and fuse glass powders. But those methods produce porous glass that lacks uniformity.

“That process produces glass that is not well-suited for optical applications. High-quality optics cannot have pores and lines,” Smay says. “Removal of porosity is critical to making the glass transparent.”

Together, he and collaborators developed a technique that delivers transparent, uniform glass. Instead of using molten glass, the researchers developed a colloidal gel ink that is extruded at room temperature in a programmable pattern. Once printed, the components are dried and heated using a carefully designed thermal treatment to fuse the particles into an optically transparent glass.

The development also opens the door to freeform design for optical engineers, Smay says, empowering them to create optics in virtually any complex geometry and with spatial control of composition to engineer refractive index gradients. The ability to design specifically for novel optical components rather than adapting off-the-shelf optics is expected to scale down the weight and costs of optical systems.

The multidisciplinary nature of the research team better enabled them to identify and overcome challenges in chemistry, materials, engineering, physics and optics.

“That was key to our success,” Smay says. “This breakthrough promises to tremendously open up the application space for 3-D printing technologies. We were able to create a robust and repeatable approach to printing glass.”

Smay, who is resident faculty at the OSU School of Materials Science and Engineering at OSU-Tulsa’s Helmerich Research Center, is no stranger to 3-D printing research.

Since joining OSU in 2002, he has led 3-D printing research projects using ceramics to print artificial bones and silicone to produce prosthetic noses and ears.

Four years before joining Sandia National Laboratories in Albuquerque, New Mexico — one of three National Nuclear Security Administration research and development labs — in 1999, Smay concentrated on 3-D ceramics printing research.

“My contribution to the whole world of 3-D printing is ceramics. It fascinates me because of its difficulty,” he says.

His most recent foray into the world of 3-D glass printing is a welcome challenge. Now that researchers have proven that 3-D printing transparent glass is possible, Smay says the team will continue to refine the process.

“You’re never going to print windows for your house this way, but this is an important achievement toward improving the way lasers and other optical systems perform,” he says.
The "Oklahoma 100 Years of Life" oral history project is using the collected voices of 111 centenarians in the state to add substance to the often glossed-over big pictures of history.

The work that continues on the project also exemplifies how faculty at OSU collaborate to fulfill each arm of the land-grant mission: research, education and outreach.

Tanya Finchum, of the OSU Library's Oklahoma Oral History Research Program (OOHRP), and Alex Bishop, with the OSU Department of Human Development and Family Science, spearheaded the project that collected the stories of Oklahoman centenarians.

Many contributions and perspectives are left undocumented in written versions of history. Oral history allows researchers to fill gaps by interviewing individuals about their firsthand experiences and making that material available to researchers and the public.

Finchum, whose academic background is in gerontology, was seeking a collaborator interested in using oral history to study aging. She met Bishop through a guest lecture for his winter intersession course, and he suggested looking at centenarians, his primary population of interest.

"I wanted to know about life at 100, but I also wanted to know about their childhood because that tells us a lot about living in Oklahoma at the time," Finchum says. "What was the state like in the '20s and '30s, and how did the Great Depression impact the rest of their lives?"

Initially, they aimed to collect 25 stories. But as the project progressed, the number of potential narrators grew. Bishop’s role as a gerontology faculty member made him well positioned to locate centenarians in the state. Bishop and his research assistants took a diverse approach to finding subjects. Working with county Extension Community Educators, scouring media for birthday celebrations and even searching obituaries for mentions of surviving centenarians offered a growing list of leads.

"Think about it: If a person dies in their 80s, and their obituary mentions they are survived by a parent, that parent is likely to be near 100 years old," Bishop says.

A new target of 100 subjects was set. As the researchers closed in on that, Bishop shifted the focus to less-visited areas of Oklahoma and sought out varying demographic attributes to round out the composition of narrators. As a result, the collection is richer and more inclusive.

In addition to gathering robust qualitative data about the lives of people living to the age of 100 and beyond, the collaboration explored the impact of how sharing a life story affected their satisfaction with life. Bishop focused on pre- and post-psychometric assessments of subjective well-being while Finchum led the qualitative oral history interviews.

The collection holds a wealth of data, and Bishop wanted to bring that into his classrooms. He began to incorporate interviews from the project into his Adult- hood and Aging course, asking students to select a centenarian from the collection and write a life analysis paper. He later went on to use the collection in a graduate-level online course.

Oklahoma centenarians enrich the state’s story with oral histories

IN THEIR OWN WORDS

Herman Harper, born 1912, Mooreland, Okla.

Emma Shelton, born 1914, Shawnee, Okla.

Dena Andis, born 1915, Miami, Okla.

PHOTOS/TANYA FINCHUM

By Bonnie Cain-Wood

Details.

Nuances.

Individual affects.

"The Oklahoma 100 Years of Life" oral history project is using the collected voices of 111 centenarians in the state to add substance to the often glossed-over big pictures of history.

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In October 2017, “Oklahoma 100 Years of Life” was recognized by the American Oral History Association with the Elizabeth B. Mason Award that recognizes an outstanding oral history project of noteworthy scholarly and social value.

In a letter of support for the nomination, Sissy Osteen, head of Human Development and Family Sciences, wrote, “This project is a testament of collaboration between social-behavioral experts, library scientists, and humanities scholars who have aimed to bridge methodological approaches. Outcomes exemplify how meaningful research collaborations are vital to worthy oral history projects.”

He has presented and published his preliminary findings and is excited about his continued work with the collection. Finchum and Pearson-Little Thunder have also presented on the project, both in-state and nationally.

“We’re just beginning to scratch the surface,” Bishop says. “We haven’t even finished our initial analyses.”

Bishop is confident a number of interesting research angles awaits in the collection of data. He would like to follow the subjects to see if there are meaningful connections between themes in their interviews and the subjects’ ultimate lifespans.

Finchum and Bishop spent three years collecting the interviews and related data. The staff of the Oklahoma Oral History Research Program has transcribed each interview; the texts, recordings and some photographs are available online. Find the “Oklahoma 100 Years of Life” oral history project at library.okstate.edu/oralhistory/digital/100. To learn more about the OOHQP call 405-744-7685, email liboh@okstate.edu, or visit library.okstate.edu/oralhistory/.

The play “Centenarians” brought together community actors and OSU Theatre students to present stories from the lives of Oklahomans who have lived to be 100. Centenarians portrayed included (from left) Vance Trimble (played by John Mark Day), Delmar Hopkins (played by Simone Pinnock) and Fred Scott (played by Will Weigand).

OSU faculty members Alex Bishop, in the Department of Human Development and Family Science, and Tanya Finchum, with the Oklahoma Oral History Project, spearheaded the nationally recognized project.

Assignments such as these aren’t unusual in gerontology studies, but the team was interested in taking the classroom component in an innovative and humanities-focused direction. A third collaborator was added: Julie Pearson-Little Thunder, a visiting assistant professor with the OOHQP, brought her academic and professional theater background to the project.

Using the oral history collection as source material, Pearson-Little Thunder wrote an original theatrical production, Centenarians, featuring five of the interviewed centenarians as characters. Excerpts from the interviews were woven into a one-act play. The fictional characters of Luck and the Writer helped piece the personalities-focused direction. A third collaborator was added: Julie Pearson-Little Thunder, a visiting assistant professor with the OOHQP, brought her academic and professional theater background to the project.

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Pearson-Little Thunder then brought her directorial experience into Bishop’s classroom. She led students through acting exercises designed to increase awareness of what it might be like to live to 100 and beyond. One goal of this interactive learning activity was to answer the question: What does it mean to grow old?

“I think people have an experience with live performance that they don’t get in any other way,” Pearson-Little Thunder says. “Elements of it are equivalent to the experience you have when you’re interviewing somebody because there’s a dynamic interchange.”

The success of the dramaturgy class assignment aided Bishop in obtaining a small grant that supported the outreach element of the project. Centenarians was brought out into the community with two public performances featuring professional actors. Pearson-Little Thunder directed the productions, and the reach of the project expanded into another academic department with the addition of Maria Beach, a faculty member from the OSU Department of Theatre, serving as assistant director.

“Performance is a great way to get oral histories out to a community, and it’s an especially great way to get people interested in reading these oral histories and invested in them,” Pearson-Little Thunder says.

The performances ultimately provided another research element. Bishop conducted focus groups with the performers and surveyed the audiences to examine if attitudes and perceptions of aging and the aged changed after viewing the play.

“The pre- and post-audience assessments looked at age beliefs and empathy,” Bishop says. “Early results indicate that following the play audiences showed increased empathy and more positive and realistic aging beliefs.”

A recording of Pearson-Little Thunder’s production is now available on OStateTV. Search the channel for Centenarians.

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In October 2017, “Oklahoma 100 Years of Life” was recognized by the American Oral History Association with the Elizabeth B. Mason Award that recognizes an outstanding oral history project of noteworthy scholarly and social value.

In a letter of support for the nomination, Sissy Osteen, head of Human Development and Family Sciences, wrote, “This project is a testament of collaboration between social-behavioral experts, library scientists, and humanities scholars who have aimed to bridge methodological approaches. Outcomes exemplify how meaningful research collaborations are vital to worthy oral history projects.”

He has presented and published his preliminary findings and is excited about his continued work with the collection. Finchum and Pearson-Little Thunder have also presented on the project, both in-state and nationally.

“We’re just beginning to scratch the surface,” Bishop says. “We haven’t even finished our initial analyses.”

Bishop is confident a number of interesting research angles awaits in the collection of data. He would like to follow the subjects to see if there are meaningful connections between themes in their interviews and the subjects’ ultimate lifespans.

Finchum and Bishop spent three years collecting the interviews and related data. The staff of the Oklahoma Oral History Research Program has transcribed each interview; the texts, recordings and some photographs are available online. Find the “Oklahoma 100 Years of Life” oral history project at library.okstate.edu/oralhistory/digital/100. To learn more about the OOHQP call 405-744-7685, email liboh@okstate.edu, or visit library.okstate.edu/oralhistory/.

The characters Lady Luck (played by Bonnie Cain-Wood) and the Writer (played by Tabitha Manners), were used to weave together narratives from five centenarian interviews.

OSU RESEARCH MATTERS
The world’s consumption of energy, especially petroleum-based energy, is increasing at an unprecedented pace. In an effort to proactively identify alternative fuel sources, the U.S. Department of Transportation, U.S. Department of Agriculture and U.S. Department of Energy formed a partnership to launch the Sun Grant Initiative in 2002. Based upon its niche of capabilities and faculty expertise, Oklahoma State University was designated as a Sun Grant university in 2004 to serve as the nation’s South Central Regional Center. This role places OSU faculty in a unique position of national leadership in research to help secure the world’s energy future.

Keith Owens, Director, South Central Sun Grant Region
Associate Vice President, Oklahoma Agricultural Experiment Stations

Land-grant universities are ideally situated to conduct the Sun Grant Program because of the unique combination of research expertise and community outreach. Working with the Cooperative Extension Service, this information is distributed to Oklahoma citizens and entrepreneurs.

Ray Huhnke, Associate Director, South Central Sun Grant Region
Professor, Biosystems and Agricultural Engineering

The concept of the Sun Grant Program was for land-grant universities with the appropriate expertise to provide leadership in building the bioeconomy through research, education and extension. A key element has been working with industry, sharing scientific discoveries and technology advances.

Ajay Kumar, Associate Professor, Biosystems and Agricultural Engineering

As a Sun Grant university, OSU reinforces its land-grant mission by not only conducting basic scientific research but also applying the scientific knowledge gained to uplift rural communities, enhance national energy security and energize the U.S. economy.

Sun Grant brings home-grown biobased opportunities to America

By Amy Dronberger

In the early 2000s, professors at South Dakota State University recognized a significant increase in petroleum-based fuel consumption and began discussing alternative options with U.S. Sen. Tom Daschle. With his support, the Sun Grant Initiative was authorized under the Farm Security and Rural Investment Act of 2002, and has since been renewed in the 2008 and 2014 Farm Bills, to support biobased alternatives research, including research that drives biobased educational programs and rural economic development.

Established through a collaborative partnership between the U.S. Department of Transportation, the U.S. Department of Energy and the U.S. Department of Agriculture, the Sun Grant Initiative has five regional centers, each led by a land-grant university to research the biomass sources that are unique to each region. Oklahoma State University leads the South Central Sun Grant Center and provides stewardship of the program in an eight-state region that includes Arkansas, Colorado, Kansas, Louisiana, Missouri, New Mexico, Oklahoma and Texas.

The Sun Grant Initiative was developed with a four-part mission:

- To enhance national energy security;
- Provide rural economic development opportunities;
- Promote environmentally sustainable and diverse production opportunities for the agricultural and forestry industries;
- And to encourage collaboration between government agencies and land-grant colleges and universities toward bioenergy research.

“Research faculty conduct a wide variety of basic and applied research in growing, processing, and refining bioproducts that can be used to bolster community development,” says Keith Owens, director of the South Central Sun Grant Center.

Focused on regional strengths, the South Central Sun Grant Center has awarded more than $7.5 million in USDOT and $2.8 million in USDA funds since 2006 for biobased research in feedstocks, energy- and cost-efficient logistics, conversions technologies and economic modeling.

“The program continues today with researchers and educators working to enhance America’s energy security while providing opportunities for economic development, especially for rural communities,” says Ray Huhnke, the center’s associate director.
Ray Huhnke, professor of biosystems and agricultural engineering and a leading researcher in biofuel conversion, describes a scaled up demonstration gasification system developed at OSU.

“Our results demonstrate that co-fermentation of sugars and gases can be feasible and can enhance the biobased economy.” — Hasan Atiyeh

The launch of the Sun Grant Initiative in 2002 propelled a national network of land-grant universities on a mission to develop alternative biofuels and biobased products to create rural economic opportunity.

Sun Grant’s five regional centers bring unique expertise to the network. The South Central Sun Grant Region university network, based at Oklahoma State University, focuses on improving the production of plant-based feedstocks and developing technologies to convert that biomass into liquid fuels, lubricants, plastics, solvents and other products. Researchers are also examining the economics of a biobased industry.

Economic benefits would come from using non-food feedstocks like switchgrass, sorghum, crop residues and woody plants like eastern redbud, which would offer farmers and landowners potential income from underutilized land. An example of feedstock research at OSU is developing new switchgrass varieties with higher yields and drought tolerance. Other studies are looking at using municipal waste and algae as biomass.

OSU researchers have pioneered the process of converting feedstocks into biofuels with the goals of supplementing or replacing fossil fuels, decreasing carbon dioxide emissions and creating jobs. Developing rural economies around growing and converting biomass into sustainable, alternative fuels is a central goal of the Sun Grant Initiative. Interest in turning biomass and agricultural and industrial wastes into energy is not limited to the United States.

“OSU is a leading institution worldwide for the hybrid gasification-syngas fermentation technology,” says Hasan Atiyeh, OSU associate professor of biosystems and agricultural engineering. “I receive questions from China, India, Canada, the U.K. and the U.S. about how to develop this technology — what is needed to make this technology feasible to make biofuels using grasses, wood, crop residue, steel mill off-gases and petroleum coke?”

Turning biomass into alternative energy involves using gasification technologies developed at OSU.
marketable chemicals. Researchers like Atiyeh are working to develop and improve conversion technologies that are sustainable.

Atiyeh is one of more than a dozen OSU Sun Grant-funded researchers in biosystems and agricultural engineering, plant and soil sciences, microbiology and molecular genetics, chemical engineering, agricultural economics and at the Food and Agricultural Products Center. OSU research talent is paired with that of colleagues from 12 South Central Sun Grant Region universities. At the heart of the program is harvesting the expertise of researchers across disciplines through multi-institutional collaboration.

Atiyeh, also a member of the Bio-based Products and Energy Center in the OSU Division of Agricultural Sciences and Natural Resources, and his collaborators have received several Sun Grants since 2009 that have funded the development of new conversion processes to improve the efficiency of biofuel production. Examples of his research include the development of a novel biocatalytic process to convert eastern redecder to butanol. The pest tree, which has little economic value and is difficult and expensive to control, has spread across the Midwest and Central Plains, including Oklahoma. Atiyeh and co-principal investigator Mark Wilkens have shown that milled redecder can be efficiently converted into butanol.

The research estimated that using 2,000 dry metric tons of redecder per day with the novel biocatalytic process could increase a bioenergy’s net revenue by $83 million a year compared with traditional fermentation methods. It is estimated that more than 31 million metric tons of eastern redecder in northwest Oklahoma alone. It’s easy to see why processing redecder into a co-fermentation method. This innovation produces alcohols from co-fermentation of sugars released from processed biomass and gas byproducts, which were previously lost in the process, wasting energy.

"More than 30 percent of the carbon in sugars is lost to production of hydrogen and carbon dioxide, which are wasted during butanol production via the traditional fermentation method," Atiyeh says.

Co-fermentation experiments have shown the novel biocatalytic process could increase alcohol yield by 25 percent over traditional fermentation. This more efficient process is being studied to make butanol, which has a higher energy content than ethanol, the most common biofuel used in the U.S. Currently, about 15 billion gallons of ethanol are blended with gasoline each year.

According to Atiyeh, butanol has tremendous economic potential when converted to jet fuel. Each year, 20 billion gallons of jet fuel are used in the U.S. Even if bio-based butanol replaced just 25 percent of the jet fuel used by the U.S. Navy in a year, it would have an economic impact of more than $1 billion, he says.

By fermenting both sugars and the otherwise waste stream of hydrogen and carbon dioxide, the amount of alcohol made was increased dramatically. This improved efficiency has the potential to make butanol production commercially viable. In 2007, Atiyeh applied for a provisional patent for the co-fermentation technology.

"Our results demonstrate that co-fermentation of sugars and gases can be feasible and can enhance the biobased economy," he says.

Novel microorganisms that make alcohols from syngas have been characterized, and patented, at OSU. For a sustainable biobased economy, it is necessary to develop OSU technology into a commercially viable process to make alternative fuels that can compete with fossil fuels. Researchers are continually working to genetically improve the productivity of bacteria and its ability to make various products.

"My vision is the implementation of OSU technology in future bioenergy systems that can enhance our economy with sustainable fuels and chemicals to support agriculture, food, the environment, and biotechnology and energy industries," says Atiyeh.

For now, Atiyeh’s research involves process modeling and lab-scale demonstrations of feasibility. But future work by Atiyeh and his colleagues across the region will lead to prototype designs and scaled up versions with the potential for commercialization.

With Sun Grant supporting his research since 2009, Atiyeh credits the program with furthering not only his research but the work of dozens of scientists and engineers at OSU and universities in the South Central Sun Grant Region.

"Sun Grant funding has been important in advancing conversion technologies and the success of my research program. It has allowed experimentation to investigate cutting edge, innovative concepts that can be applied in establishing sustainable bioenergy systems in the nation and the world," he says.

Atiyeh works on the butanol production process.
OSU researchers search for solutions to the produced water problem

BY JEFF JOINER

Production costs are important in every industry, but Oklahoma’s energy industry is searching for answers to keep costs low and address environmental concerns. Today, Oklahoma State University researchers are working to improve ways to dispose of produced water, a byproduct of oil and gas extraction, to lessen impacts on the environment and the bottom-line.

Hydraulic fracturing has revolutionized oil and gas extraction in the United States, but the process results in produced water, which contains toxins, suspended solids and high concentrations of salt. Oil companies must transport produced water to sites where it is injected into underground disposal wells, a controversial and expensive approach. Safe and cost-effective solutions to dealing with produced water are needed.

Concerns about produced water have taken on new urgency as public, legislative and regulatory scrutiny grows. In 2015, Oklahoma Gov. Mary Fallin organized the Water for 2060 Produced Water Working Group to deal with growing production of water as public, legislative and regulatory scrutiny grows. In 2015, Oklahoma Gov. Mary Fallin organized the Water for 2060 Produced Water Working Group to deal with growing production of water.

Researchers at the University of Oklahoma are working to improve ways to dispose of produced water, a byproduct of oil and gas extraction, to lessen impacts on the environment and the bottom-line.

In lab conditions, Kim says the membrane can separate 98 percent of oil from water. A major weakness with all water purification membranes is fouling. With repeated use, oil fouls the membrane and shortens its life. “Tons of research is being done on this problem,” Kim says.

As Oklahoma residents and government and legislative leaders seek solutions, OSU researchers will be on hand provide answers.

Kevin Wagner returns to Oklahoma with water expertise

BY DON STOTTS

In 2017, Kevin Wagner became director of the Oklahoma Water Resources Center, the hub of water-related research and Cooperative Extension activities in Oklahoma. A part of the OSU Division of Agricultural Sciences and Natural Resources and supported by the Division of the Vice President for Research, the center focuses on efforts to manage and sustain water quality and quantity, especially in regards to the state’s agriculture water supply.

“It is a rare opportunity to lead a water center, given there are only 54 such centers in the United States,” Wagner says. “Leading DASNR’s elite center allows me to do what I enjoy: helping people, organizations and communities address water issues while helping to train and mentor students, who are our future leaders and problem-solvers.”


A Cowboy alumnus, Wagner earned his master’s degree in environmental science at OSU in 1995. He earned his bachelor’s degree in biology and his doctorate in agronomy from Howard Payne University and Texas A&M University, respectively.

“Dr. Wagner knows Oklahoma water issues well from experience he gained earlier in his career with the Oklahoma Conservation Commission and as a graduate student at OSU,” says Tom Coon, DASNR dean, director and OSU vice president of agricultural programs. “He has been successful at fostering a collaborative approach to water research in his role as assistant director of the Texas Water Research Center, and he brings that proven experience to OSU as our new water center director.”

In 2017, Wagner was named to the Thomas E. Berry endowed professorship in Water Research and Management. The endowed professorship focuses on sustaining Oklahoma’s water supply by helping agricultural producers, landowners and the public make informed and beneficial decisions about water use and management.
Energy harvesting could power electronic ear tags

By Aubrie Bowlan

“Basically, think of it as a Fitbit for cows”

That’s how Ryan Reuter, associate professor of animal science, and a research team at Oklahoma State University led by Sabit Ekin, assistant professor of electrical and computer engineering (ECE), describe technology they are developing. The team is designing a device built into an ear tag to keep track of livestock and monitor their health.

“This interdisciplinary research project has great potential as a commercial product,” says Ekin. “A strength of the project is collaboration among a multi-disciplinary research team, which includes expertise from ECE, animal science, agricultural engineering and entrepreneurship to develop the best possible livestock monitoring and management system.”

Ekin, a faculty member in the College of Engineering, Architecture and Technology, met his future collaborators Reuter, from the College of Agricultural Sciences & Natural Resources (CASNR), and Jingtong Hu, a former OSU assistant professor of ECE, at a research networking event sponsored by the OSU Technology Development Center and joined forces to use their individual expertise to develop a needed device.

“T’m interested in technology and data, and I think we’re seeing that those issues are starting to have a lot more value to the (livestock) industry,” Reuter says. “We now understand that if we can measure these traits, we can improve profitability, sustainability and animal welfare.”

The livestock monitoring system will use the Internet and energy harvesting methods built into small, affordable and easy to use devices contained in ear tags. Collected data are transmitted to a base station and then relayed to the user’s laptop or phone using the Internet and cloud-based technologies. In addition to whereabouts, the system will collect blood pressure, temperature and heart rate data.

With their engineering expertise, Ekin and his graduate students are building components of the device for data communications and sustainable power. Heavy, expensive batteries are out of the question, so the team is exploring harvesting energy from solar panels on the animals, motion sensors, thermal energy and radio frequency techniques. A prototype is in the works.

Reuter, with his expertise in livestock management, sees many benefits of the system ranging from rapid detection of health problems to improving land management to reducing the carbon footprint of the cattle industry. Reuter says there are similar commercial products on the market but each company focuses on only one trait rather than measuring location, health and activity simultaneously.

“We can use the data to review how the animal is performing, and if we have this data, we can make the process more efficient,” Reuter says. “That means producing food at a lower cost, which benefits everyone.”

The National Science Foundation I-Corps Site program provided funding for the project and the researchers have met with potential customers to gauge interest.

Once the prototype is developed, it will be tested using cattle at the 800-acre OSU Animal Science Blue-stem Research Range. The base stations will have a range of about 10 miles.

“Oklahoma is the perfect place for this,” Reuter says. “A lot of our state’s economy is dependent on cattle production. It’s important to do this kind of research so we maintain the vitality of the beef cattle industry in Oklahoma.”

In 2017, the team won the OSU President’s Cup for Creative Interdisciplinarity for the monitoring system concept. The award, which includes $5,000, recognizes interdisciplinary instruction, research and service. Along with Ekin, Reuter and Hu, the team includes John Long, assistant professor, biosystems and agricultural engineering, CASNR; Chris Richards, professor, animal science, CASNR; and Richard Gajan, clinical assistant professor in entrepreneurship, Spears School of Business.
NASA created the National Space Grant Program in 1989 to involve more K-12 and higher education students, and future and current teachers in aeronautics and space education. Space Grant includes more than 850 universities and colleges, government agencies, industry and others, including 16 affiliates in the NASA Oklahoma Space Grant Consortium. The group, led by OSU, feeds NASA funding to projects across the state including Speedfest at OSU where engineering students design, build and fly unmanned aircraft; the NASA Rover Challenge where students like those at Southwestern Oklahoma State University compete to build a working rover, and Mission to Planet Earth where pre-service teachers throughout Oklahoma participate in a 1-year mentorship in hands-on science, technology, engineering and mathematics (STEM) activities with classroom applications. Space Grant is helping to educate future engineers, scientists and teachers.

Andy Arena, Director of the Oklahoma Space Grant Consortium and Professor in Mechanical and Aerospace Engineering

In each state, down to the most rural of schools, students can participate in a NASA program. That’s the genius of Space Grant. We have teachers telling us that they have had kids who had no intention of leaving their hometowns or going to college who end up being aerospace engineers. That’s why we’re here. That’s a great way Space Grant has made an impact, a lasting impact.

Steve Marks, Retired NASA Education Projects Director and Co-investigator for the NASA STEM Pathway Activities – Consortium for Education (NSPACE).

The Oklahoma Space Grant Consortium, as part of the NASA Space Grant program, has made it possible for Oklahoma institutions, teachers and students to participate in NASA research programs. NASA’s Space Grant emphasizes STEM education and has brought to K through 12 and college students exciting hands-on research experiences that open minds to the possibilities of science and engineering careers, while preparing the next generation of science teachers.

Jamey Jacob, Director of the Unmanned Systems Research Institute and Professor in Mechanical and Aerospace Engineering

Through Space Grant, we have had over a hundred undergraduate students participate in cooperative research experiences with NASA. These unique real-world projects have not only provided students with practical knowledge, each effort involved a problem of interest to NASA, allowing a win-win for the students and NASA’s air and space exploration efforts. Each culminated in a visit and final presentation to NASA scientists and engineers at the Johnson, Marshall, or Kennedy Space Center.

By Jeff Joiner

NASA Space Grant: Laying the foundation for a future high-tech workforce

NASA’s mission has always included education and public outreach. In 1989, Congress created the NASA Space Grant program to give students and teachers opportunities to participate in the space agency’s research and education projects.

The Space Grant program works with states to grow a high-tech workforce by encouraging students to pursue careers in STEM fields (science, technology, engineering and mathematics), particularly in space and aeronautics. The program also focuses on opening doors to women and minorities.

Space Grant is a national network of 52 consortiums. The Oklahoma Space Grant Consortium was started in 1991 by Cameron University, Langston University, Oklahoma State University and the University of Oklahoma. Today, there are 16 affiliates in the state including universities and community colleges, private industry, science education programs and cities.

The Oklahoma Space Grant Consortium founding director was Victoria Snowden from OU, who grew the program until she died in 2016. Her deputy director, OSU’s Andy Arena, a professor in mechanical and aerospace engineering, became director in 2017.

“The Oklahoma Space Grant Consortium uses NASA grants to fund projects that reflect the strengths of those organizations and help meet NASA’s goals and objectives. NASA sends more than $760,000 annually to Oklahoma to fund projects,” Arena says.

“Every state has strengths, and Oklahoma’s affiliates have strengths in hands-on aeronautics and engineering, weather and climate research, and robotics, which are just a few examples,” Arena says.

One of Space Grants’ biggest impacts has been building OSU’s aeronautical engineering program. Grants helped fund the beginning of OSU’s design, build and fly aeronautics competition called Speedfest and the start of the university’s unmanned aerial systems program.

“The state’s teachers have benefited from the Oklahoma Space Grant Consortium Educator Resource Center at OSU, which provides NASA resources to help teachers with STEM curricula. More than 2,000 Oklahoma students have received hands-on training in NASA-related STEM areas.

“Space Grant allows us to develop a foundation in aeronautics and space education not so much in infrastructure but in people and experience and reputation. That’s really what Space Grant does,” Arena says.
Long used by the military, drones have become a common toy and tool for business, but they are increasingly becoming a security problem.

The Unmanned Systems Research Institute (USRI) at Oklahoma State University is researching technologies to combat unmanned aerial systems (UAS) that can be used as weapons and to gain undetected access to normally secure facilities like military installations. Jamey Jacob, director of the institute and a professor of mechanical and aerospace engineering (MAE) at OSU, says the nature of drone technology has created a new need for counter-UAS research.

“We didn’t even know this would be an issue two years ago,” Jacob says. “I think this is something that’s going to be ongoing for quite a while because we see technology very quickly evolving and adapting. There’s going to be a need for this.”

Jacob called unmanned aircraft a major threat to homeland security, saying ISIS or other terrorist groups could use these types of aircraft. Drones can be used in a variety of ways — for reconnaissance or to shoot video of attacks to use as propaganda. And of course, they are a variety of ways — for reconnaissance or to shoot video of attacks to use as propaganda. And of course, they are a variety of ways — for reconnaissance or to shoot video of attacks to use as propaganda. And of course, they are used as weapons, he notes.

“As soon as we figure out what they’re doing and put out a countermeasure, they’re making changes,” Jacob says. “They’re increasingly making these more and more sophisticated.”

The goal of research by MAE graduate students is to provide and evaluate tools for the U.S. Department of Defense. The agency brought the research need to the attention of OSU faculty through the Maneuvers Fire Integration Experiment program at Fort Sill near Lawton, Okla., the lead program for counter-UAS activities in the military.

“There are very few organizations that have the broad sweep of capabilities that we have in terms of unmanned aircraft systems,” Jacob says. “The unique thing about it is that we’re not just going out and buying things off the shelf. We have our own in-house development, so we can replicate systems very easily.”

Gary Ambrose, director of strategy and applied research at USRI, echoed how important it is that the students’ intimate knowledge of the inner workings of aircraft. Ambrose attributes this to the hands-on experience students receive in the UAS program through things such as Speedfest, an annual OSU flight performance competition where teams of seniors design, build and fly unmanned aircraft.

Ambrose says. “You don’t have to be an engineer to make a bomb and do real harm.”

Although the biggest threats are drones used to deliver weapons, there are many other damaging uses for unmanned systems, researchers say. Other risks include drug cartels smuggling narcotics into the country, people delivering contraband into prisons, and terrorists interfering with commercial and military aircraft.

“They’re got a great knowledge of all these small, commercial UAVs, so we have engineers who really know the systems inside out,” Ambrose says. “They can use predictive analysis of what people might do with them. Instead of watching what’s happening on the news today, they’re so immersed in this technology that they’re able to foresee what people might do with it.”

Part of the research focuses on acoustic detection, which uses an array of specialized microphones and gives accurate data for when a human can hear a UAV coming and how much time they have to prepare at various noise levels and altitudes. Ambrose said the importance of learning how to detect and disarm drones is greater than ever.

“The primary effects we’d like to see from this research is that we’re able to help the military defend itself and to grow research at OSU,” Ambrose says. “It’s really a technology race, but the professors and students here have such a competent knowledge of these systems that we’re able to stay a little ahead, which is the whole goal of the program.”

The institute has joined with the Center for Fire & Explosives, Forensic Investigations, Training and Research at OSU’s Center for Health Sciences in Tulsa to give researchers accurate simulated conditions.

The students currently measure data by flying unmanned aircraft and simulated bombs, using the same weight and flight characteristics used in overseas attacks, to observe how accurate a bomb could be from certain altitudes and what kind of damage it could do.

Nefarious organizations are increasingly employing commercial, off-the-shelf unmanned aerial vehicles,” Ambrose says. “You don’t have to be an engineer to make a bomb and do real harm.”

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Although the biggest threats are drones used to deliver weapons, there are many other damaging uses for unmanned systems, researchers say. Other risks include drug cartels smuggling narcotics into the country, people delivering contraband into prisons, and terrorists interfering with commercial and military aircraft.

“These are real issues we’re going to have to deal with in the future,” Jacob says. “A lot of this will be focused on learning how to make sure the airspace is protected. That’s the end goal.”

To learn more about the Unmanned Aircraft Systems program in the College of Engineering, Architecture and Technology, visit unmanned.okstate.edu.
Pretty heady stuff for an education professor from Oklahoma who only a year earlier had become the first director of Oklahoma State University’s education partnership with NASA. Working with technicians, scientists, administrators and even astronauts, Wiggins watched the space program take off while helping to develop the space agency’s national education programming through contracts with the College of Education (now the College of Education, Health and Aviation).

“This opened up a whole new world to me,” says Wiggins.

For 50 years, the OSU-NASA partnership has opened up new worlds of science and math for thousands of students across the United States. In 1968, OSU took on its first job leading an education project for the space agency. Working with the Johnson Space Center in Houston, the College of Education put together a plan to send former mathematics and science teachers to schools in eight states from Texas to North Dakota to tell and demonstrate the space agency’s amazing story to students and teachers in kindergarten through 12th grades (K-12).

A look at OSU’s five decades of taking space science to schools

We all have heroes, but few of us can say we’ve sat down for dinner with one of the nation’s quintessential heroes. In 1969, Kenneth Wiggins had dinner with Neil Armstrong just days before the astronaut’s Apollo 11 mission, where he became the first person to walk on the moon.

Pretty heady stuff for an education professor from Oklahoma who only a year earlier had become the first director of Oklahoma State University’s education partnership with NASA. Working with technicians, scientists, administrators and even astronauts, Wiggins watched the space program take off while helping to develop the space agency’s national education programming through contracts with the College of Education (now the College of Education, Health and Aviation).

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Wiggins, a science education professor at OSU, hired and trained the teachers and worked with the Johnson Space Center to put together materials, displays and curricula. The assignment was straightforward: Spread the word about NASA’s mission to a national audience thrilled by space flight and manned moon missions.

Education and outreach have always been important parts of NASA’s mandate. Congress required the agency to share the science and technology behind its missions with the public. Programs for K-12 students and teachers became one of its most important outlets. It’s no surprise that schools happily welcomed the NASA education specialists arriving on their doorsteps with models of lunar landers and ready-made science and math curricula.

“It was important that our people were all past teachers,” says Steven Marks, a former junior high
“It was a difficult time for NASA after the Challenger explosion. It was Oklahoma State that assisted NASA Education through that period and worked to help make things happen and help us recover.” — Frank Owens, former NASA director of education

Wiggins was on hand at Kennedy Space Center to watch the launch when an explosion destroyed the Challenger just after liftoff, killing McAuliffe and the other members of the crew in January 1986. The Challenger disaster deeply affected Wiggins because of the role he and his team played in the Teacher in Space project.

“It was a difficult time for NASA after the Challenger explosion,” Owens says. “It was Oklahoma State that assisted NASA Education through that period and worked to help make things happen and help us recover.”

For nearly 50 years, the College of Education, Health and Aviation has continuously worked with NASA Education to manage projects. The college has worked with NASA Space Centers across the country on programs including Teacher in Space, Teaching from Space, Explorer Schools, Digital Learning Network, the Interdisciplinary National Science Project Incorporating Research and Education Experience (INSPIRE) and the current NASA STEM Pathway Activities — Consortium for Education (NSPACE) projects.

Before Marks retired as the OSU NASA Education Projects director in 2017, the College of Education, Health and Aviation announced that NASA had awarded OU a $25 million, five-year grant to fund science, technology, engineering and math (STEM) education activities for under-represented students in grades K-12 and colleges and universities. Susan Stansberry, associate professor of educational technology, and Marks, her co-principal investigator, are leading the project.

“This highlights our expertise in instructional design and facilitating projects for increasing student participation in STEMD,” says John Romans, dean of the college. “We’re a national leader in this.”

The core of OSU’s role is creating curriculum support materials and sharing NASA’s STEM research with educators and students. NASA and OSU are working together to inspire the next generation of scientists, engineers and technicians.

“OSU has always supported NASA Education and has always been the go-to institution to make things happen,” says Marks.

With a world of digital distractions such as video games and smart phones, do kids still get excited about NASA and space? After four decades working in science education, Marks says they do.

“Interest has not waned. It’s been such a part of their lives,” he says. “We’ve had men and women in space permanently since 2000. That’s 18 years that these kids, some for their entire lives, have seen somebody in space orbiting the Earth. Those kids are still in.”

Kenneth Wiggins, sitting in a space shuttle simulator, was the first director of OSU NASA Education Projects. A College of Education science education professor, he filled the role from 1968 until his retirement in 1998.

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science teacher Wiggins recruited in 1976 to join the college who later became his assistant project director. “You had to have classroom experience to be able to relate and have credibility with teachers.”

The eight-state project led by OSU became so popular that NASA took it nationwide in 1969, managed by Wiggins and the College of Education’s space education program.

Following the example of the Franklin Institute, a science museum in Philadelphia, NASA sent the specialists all over the country, equipped in vans,” says Wiggins. “They were in a different school every day.

Programs were tailored to NASA’s current missions. Over the decades students learned about the Gemini and Apollo missions; Skylab; unmanned missions to Mars, Jupiter and Saturn; the space shuttles; the International Space Station; aeronautics and many other areas. They learned the science behind using planets to “slingshot” craft through space, the chemical composition of the moon, why engineers designed lunar and Mars rovers with such huge wheels, how astronauts go the bathroom in space and countless other technical details.

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Steven Marks, hired by Kenneth Wiggins, took over as director of the OSU NASA Education Projects after Wiggins retired.

“_and once astronauts started visiting the moon, the excitement just continued to build from one mission to the next.” Programs were tailored to NASA’s current missions. Over the decades students learned about the Gemini and Apollo missions; Skylab; unmanned missions to Mars, Jupiter and Saturn; the space shuttles; the International Space Station; aeronautics and many other areas. They learned the science behind using planets to “slingshot” craft through space, the chemical composition of the moon, why engineers designed lunar and Mars rovers with such huge wheels, how astronauts go the bathroom in space and countless other technical details.

“IT was Oklahoma State and the contracts we had with them over the years that really carried out that education function for NASA from the very beginning of the K-12 program,” says Frank Owens, former NASA director of education.

NASA’s respect for OSU led it to ask Wiggins and his group to help manage the Teacher in Space program, says Owens. Sending a teacher into space captured the nation’s imagination when Christa McAuliffe, from New Hampshire, joined the crew of the space shuttle Challenger. OSU worked with local school districts to assign the teacher finalists to NASA’s space centers around the country where they worked on education projects.

“We had captive audiences everywhere my crews went. And once astronauts started visiting the moon, the excitement just continued to build from one mission to the next.” — Kenneth Wiggins, first director of OSU NASA Education Projects
Recognizing OSU’s researchers

2017 Regents Distinguished Research Awards

Each year, Oklahoma State University recognizes select researchers with the Regents Distinguished Research Award. Recipients are honored for evidence of meritorious research achievement and national and international recognition. The researchers were honored at the 2017 University Awards Convocation.

Robert Matts, Ph.D., Regents Professor and Sarkeys Distinguished Professor of Biochemistry

Division of Agricultural Sciences and Natural Resources

The internationally recognized work of Robert Matts focuses on protein synthesis and function in cells, particularly a protein that regulates cell growth and differentiation. His investigations of protein function in cells is helping scientists better understand cardic and neurodegenerative diseases and cancer. His basic and clinical research is the foundation for potential development of new cancer treatments. Matts’ research has been continually funded since 1987, and he has received seven NIH awards and a number of grants from other research funders totaling approximately $3.5 million. Matts has mentored nearly 50 undergraduate and 22 graduate students through his laboratory. Most of his graduate students have gone on to successful academic and private industry research jobs.

Jennifer Hays-Grudo, Ph.D., Regents Professor of Human Development and Family Science

College of Human Sciences

Trained as a developmental psychologist, Jennifer Hays-Grudo has focused her research on identifying and reducing childhood risk factors that contribute to long-term disparities in health and development. She and her collaborators are investigating how adverse childhood experiences — such as poverty, abuse, neglect and family dysfunction — can be risk factors for physical and mental health problems that can repeat themselves from generation to generation. In 2016, she was named director and principal investigator of the Center for Integrative Research on Childhood Diversity. Her previous research included studies at Baylor University on cardiovascular disease among Mexican-Americans and the largest study funded by the National Institutes of Health (NIH) on preventing the top causes of death and disability in women.

Flera Rizatdinova, Ph.D., Professor of Physics

College of Arts & Sciences

Flera Rizatdinova studies high-energy physics (HEP) to understand the most fundamental elements of the universe and their interactions. She came to OSU in 2005 to found a group in the department of physics to conduct experimental HEP research. Rizatdinova led the group of scientists to join two international collaborations, the ATLAS Detector experiment at CERN in Switzerland and an investigation of the interactions of protons and antiprotons at the Fermi National Accelerator Laboratory in Illinois. Her work has contributed to the development of techniques used in the discovery of the Higgs boson particle and the development of instruments for the ATLAS Detector. Rizatdinova has received $3 million in funding from the U.S. Department of Energy and the National Science Foundation.

Mark Sisson, MFA, Professor of Art

College of Arts & Sciences

Mark Sisson is a professor of printmaking and drawing. His work has been accepted by 166 national and international competitive juried exhibitions, and he has received 78 awards and purchase prizes. His work has been exhibited in the most prestigious U.S. printmaking exhibitions as well as in Germany, Poland, Norway, Slovenia, Croatia and Australia. Colleagues note his discipline, productivity and determination as a testament to excellence in his prints and mixed-media drawings. He is also known as a dedicated teacher and researcher whose work ethic makes him an example of artistic professionalism. In 2005, Sisson received the endowed Wise-Diggs-Berry Award from the College of Arts & Sciences, recognizing excellence in visual, performance or written arts.

Doug Smith, Ph.D., Professor of Exercise Physiology

College of Education, Health and Aviation

Focusing on three areas of research, Doug Smith investigates noninvasive assessment of neuromuscular function, performance changes following training, and human performance across a lifespan. Pursuing his research interests in the Musculoskeletal and Human Research Laboratory, Smith has worked with OSU athletes in cooperation with the Athletic Department. His projects include the study of muscle fatigue, the use of energy patches, seasonal changes in hydration, body composition and weight, muscle strength and range of motion. His studies of lifespan performance have examined fall prevention with aging and has collected performance variables affecting adolescents to the elderly. Smith has made integrating students into research an important part of his work and has mentored seven students who earned doctoral degrees.

Kelvin Wang, Ph.D., Professor and Gilbert, Cooper, W&B Steel Chair of Civil Engineering

College of Engineering, Architecture & Technology

Kelvin Wang is regarded as a leading researcher of automated pavement survey sensors and software for both roadways and airport runways. He invented a 3-D laser imaging sensor system in 2010 that records pavement survey data at 60 mph. The technology is used around the world. Wang was presented with the 2011 Frank M. Masters Transportation Engineering Award from the American Society of Civil Engineers for his research on automated pavement survey and data analysis. As a faculty member at OSU, Wang has received more than $3 million in external research funding. He has published more than 30 journal papers and founded and is the co-editor of the International Journal of Rail Transportation.
Cox Fellows excel on the cutting edge of genetic research

The progress of genetic research is moving at a dizzying pace. Advances in genetics, genomics, and bioinformatics have revolutionized the field and require graduate student researchers to excel with novel, cutting edge work to standout in the competitive field. Oklahoma State University's Otto S. Cox Graduate Fellowship for Genetic Research is giving two students valuable research experience.

Nathalia Graf-Grachet, a doctoral candidate studying microbiology and plant pathology, and Prakash Sah, a doctoral candidate and microbiology researcher, were recipients of the 2017 Cox Fellowship.

Graf-Grachet has sequenced the genomes of 11 fungi that infect and kill Bermuda grass, a disease known as spring dead spot. She is searching for genes that are activated when the plant pathogen and the host Bermuda grass are associated.

“’The end goal is to identify genes that are involved in resistance to this particular disease,’” Graf-Grachet says.

Sah is studying proteins in human cells associated with Chlamydia trachomatis, a bacterium causing a common sexually transmitted disease. Chronic chlamydia can lead to pelvic inflammatory disease, and in rare cases has been correlated with cancer.

“’We’re trying to understand how it infects cells at the molecular level,’” Sah says.

The Cox Fellowship supports recipients with a $1,000 stipend, but just as important as financial support, the fellowship means acknowledgment, Graf-Grachet says.

“’It’s not only about money. It’s also about recognition for our work, which I think is more valuable than anything.’”